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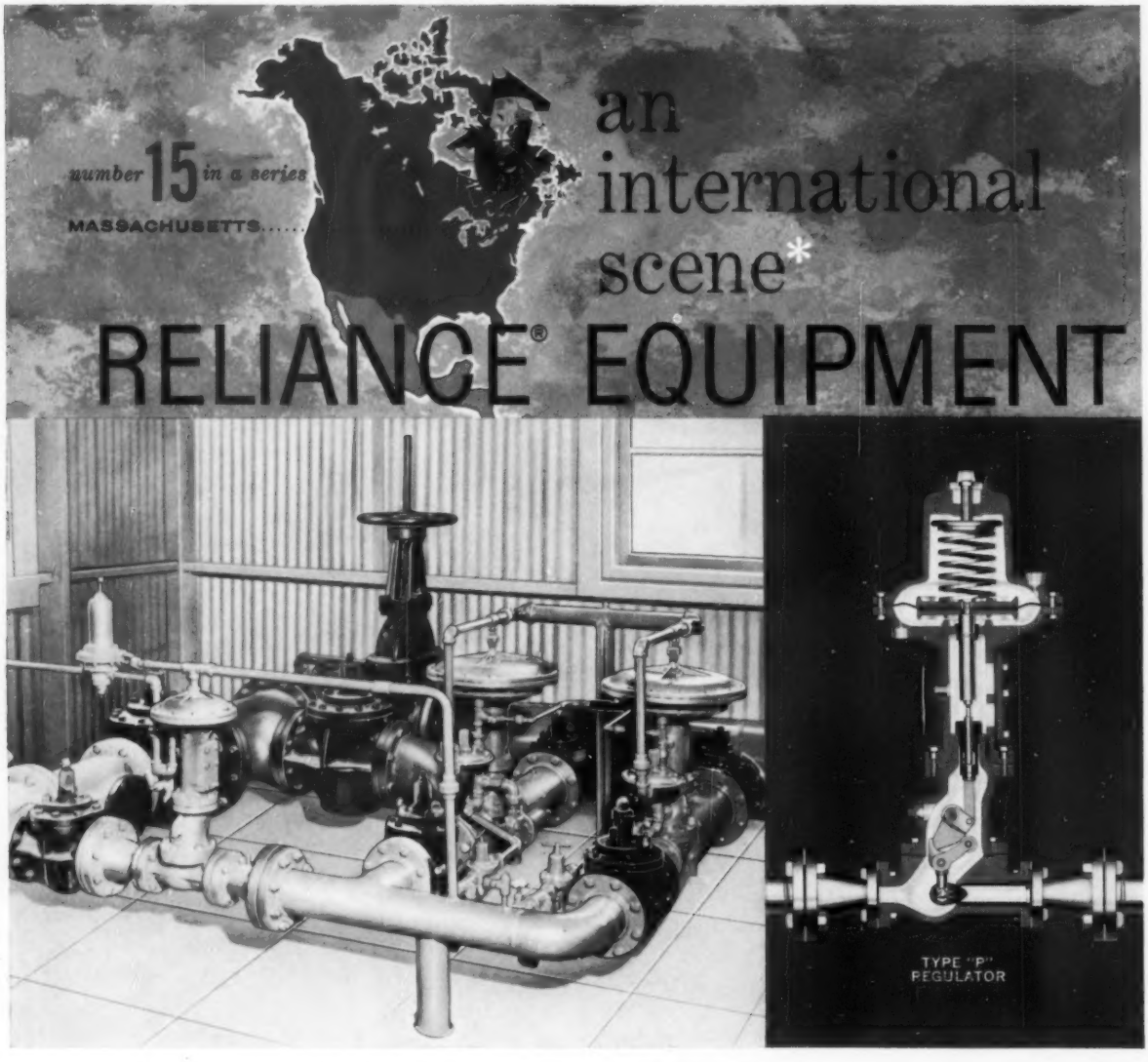

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37TH YEAR OF PUBLICATION

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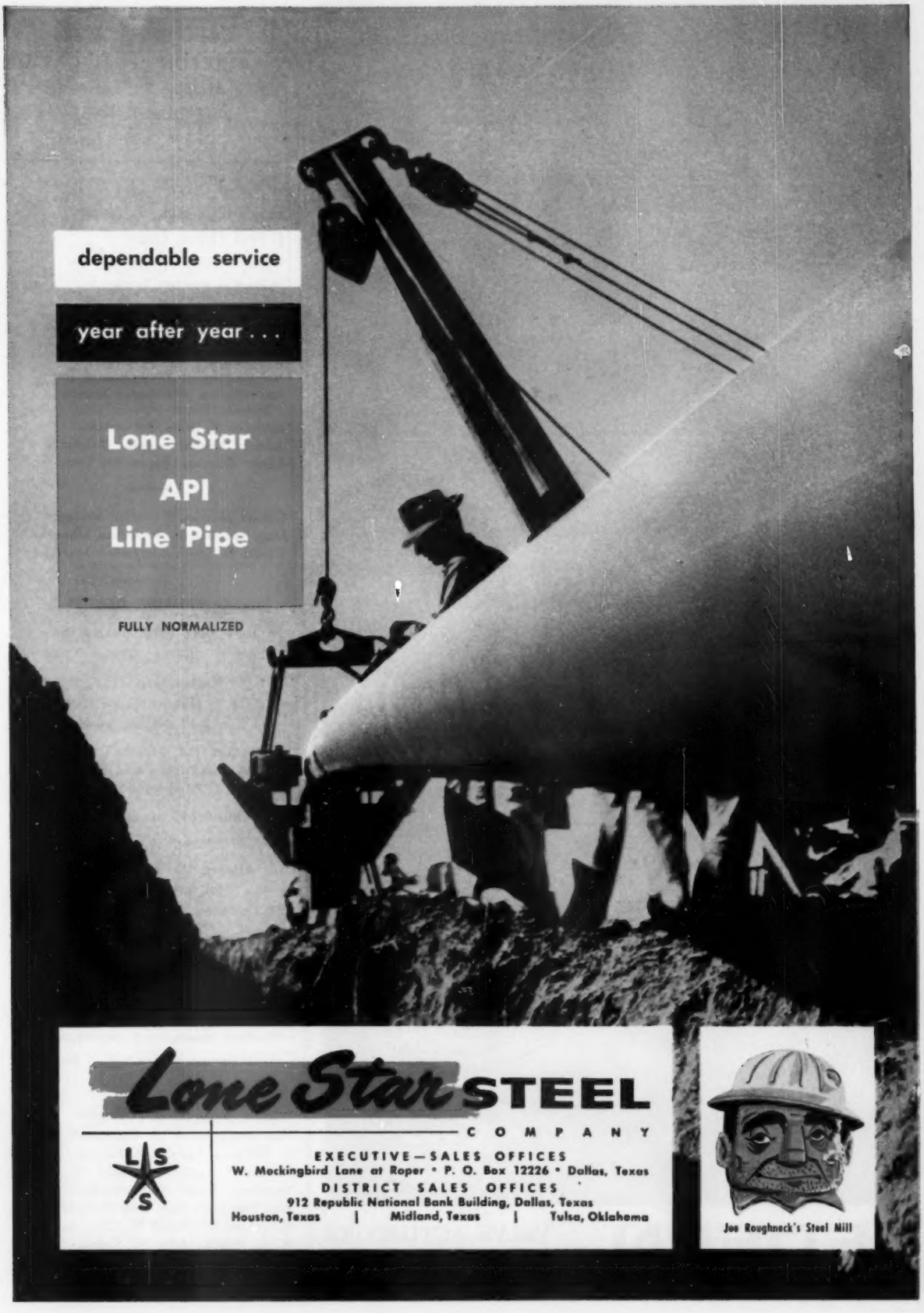

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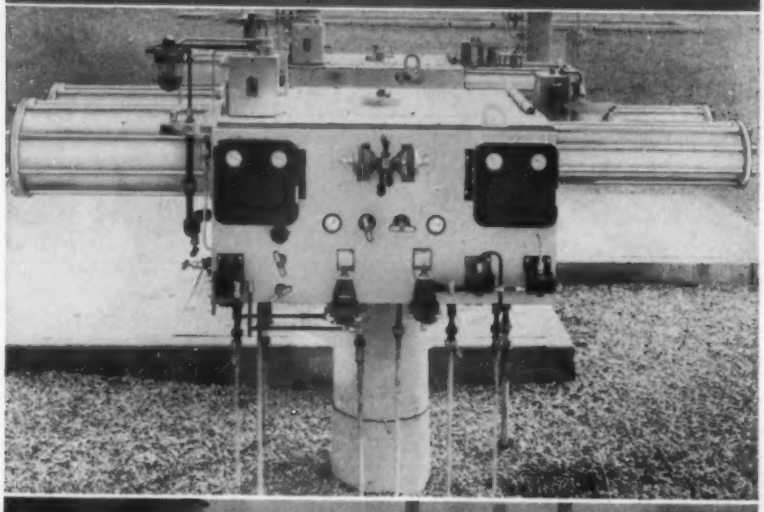

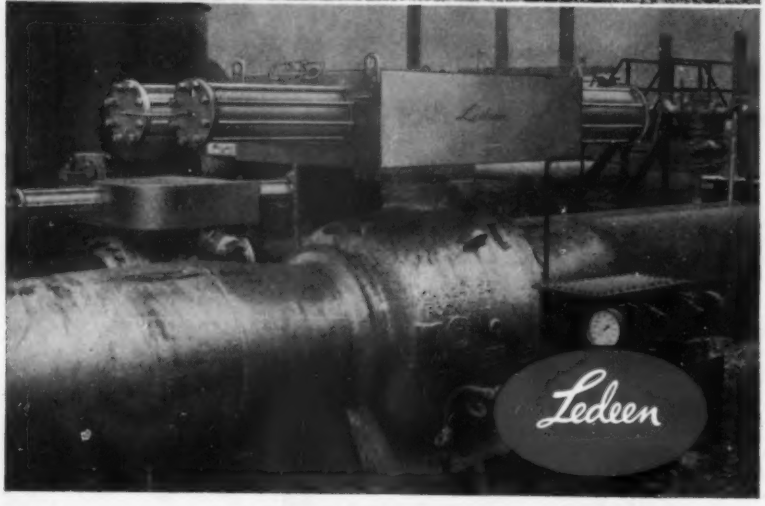

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CALENDAR

March

13-17..National Association of Corrosion Engineers Annual Meeting Hotel Statler, Buffalo.

16-17..New England Gas Association Annual Meeting — Statler-Hilton Hotel, Boston.

20-22..AGA General Management Section Conference—Frances-Marion Hotel, Charleston, S. C.

27-28..Mid-West Gas Association Annual Meeting — Sheraton-Fontenelle Hotel, Omaha.

28-29..University of Oklahoma's Gas Conditioning Conference—Norman, Okla.

28-29..10th Annual Southern California Meter Association Instrument Short Course—Los Angeles Harbor Junior College, Wilmington, Calif.

April

4-5..Gas Compressor Institute—Liberal, Kan.

4-6..AGA Research & Utilization Conference—Sheraton Cleveland Hotel, Cleveland.

6..Pennsylvania Gas Association Distribution Conference—Tally Ho Inn, Valley Forge, Pa.

6-7..PCGA Distribution Conference —Biltmore Hotel, Los Angeles.

11-13..AGA Sales Conference on Industrial & Commercial Gas — Prince Edward, Windsor, Ont., Canada

13-15..GAMA Annual Meeting—Boca Raton, Fla.

18-20..Southwestern Gas Measurement Short Course — University of Oklahoma, North Campus, Norman, Okla.

24-26..Southern Gas Association Annual Meeting—New Orleans.

May

8-12..AGA Operating Section, Distribution & Production Conference, —Sheraton Hotel, Philadelphia.

15-17..AGA MidWest Regional Gas Sales Conference — Edgewater Beach Hotel, Chicago

25-26..AGA Operating Section, Transmission Conference—Brown Palace and Cosmopolitan Hotel, Denver.

June

20-24..Canadian Gas Association Annual Meeting—Banff Springs, Alberta.

26-27..Michigan Gas Association Annual Meeting—Grand Hotel, Mackinac Island, Mich.

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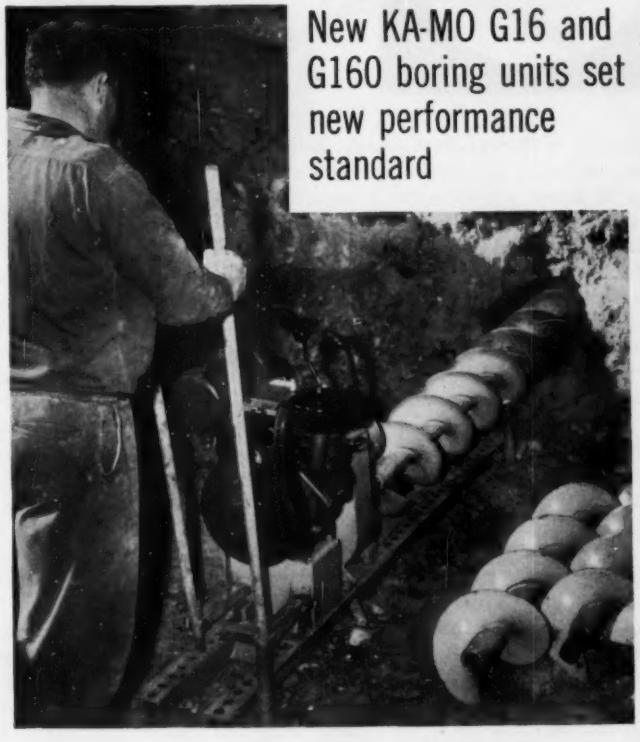

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MARCH 1961

Thermally Thinking

Who's to blame?

SOLON, a rather ancient Greek, said that democracy embodies the seeds of its own destruction because its practitioners, seeking security and having the privilege of voting for their security, will vote away their freedom.

I feel that we have taken on an administration that only vaguely recognizes the major economic problems of today. And it appears to me that those now taking a firm hitch on the federal government don't know any more about energy matters and consumers than a bull knows about a bass fiddle.

The administration, Dean Landis, and Washington fuzzy thinkers in general, cite, accurately, that prices for natural gas have doubled. Their philosophy says consumers' interest has been neglected. Their policy is more regulation of the gas industry through some indistinct type of regulatory diaper service, said to be designed for stoppage of an alleged evacuation of consumers' interest from the Federal Power Commission and natural gas industry.

Washington in general can't seem to understand that gas is not an absolutely indispensable utility. All energy consumers suffer therefrom. Gas is a fuel, and a good one. But there are other fuels—coal, oil, liquefied petroleum gas, etc.

Hence, when government through its courts, regulatory agencies, and policies stumbles around trying to set natural gas prices at levels that are economically false, they are actually fixing prices of the other non-regulated fuels. Thus free competition is eliminated. I can't think of anything that would be more salubrious to energy consumers of this nation than more competition among the several important sources of fuel energy.

Further, the net effect of federal and state gas-industry regulation itself is higher cost of gas to consumers. It is a truth that the financial world is less than enthused by the regulatory atmosphere pertaining to the gas industry. A few years ago, debt money cost gas companies maybe 3 to 4 per cent. Now it is apt to cost over 5 per cent. Why? Because of the uncertainty of regulation paths, and the regulators' intent of letting gas companies' returns on equity govern overall return on invested capital, regardless of specific companies equity ratios. Who pays for this? Gas consumers.

Dean Landis' unfortunate report, commended to all by President Kennedy, struck sharply at the clutter of FPC cases. Well, who cluttered FPC? One of the best case-litterbugs was the Supreme Court of the United States, in its Phillips decision.

Look at the cost to consumers for the mechanics of regulatory procedure. Gas companies coming before FPC (or state commissions, for that matter) must do so with mountains of paper. Single sheets thereof often hold the cumulative data of months of work by legions of gas company personnel.

To present and defend these submissions, batteries of lawyers, travel, consultants, expert witnesses, top executive time, and on and on, are required. These things and people are costly, dear hearts. A pretty hot little gas industry hearing, for example, involves more top-priced legal talent than Fort Knox could have afforded even when it had the gold. Sooner or later, no matter how indirectly, these expenses are paid for by consumers.

The natural gas industry is the only large fuel industry subjected to complete, stringent government regulation (federal or state) from production to consumers. Isn't it strange, then, to hear from Washington that consumers' interests are so miserably neglected?

To me it amounts to a self-confession. Blame is self-implaced right where it belongs on the culprit of too much government control, on the accessories of inept court decisions that go uncorrected by Congress, and politics.

Political Pied Pipers will furnish no answers. We will deceive only ourselves about our economy and economic potential if we listen to the enchantment of the learned economic theories being bounced between the Stork Club and the White House. At stake is loss of our unique enterprise system.

Washington appears to have little faith in free enterprise. So I look to the New Testament where Matthew spoke: "If you have faith as a grain of mustard seed nothing will be impossible to you."

J. Fred Ebsen
EDITOR

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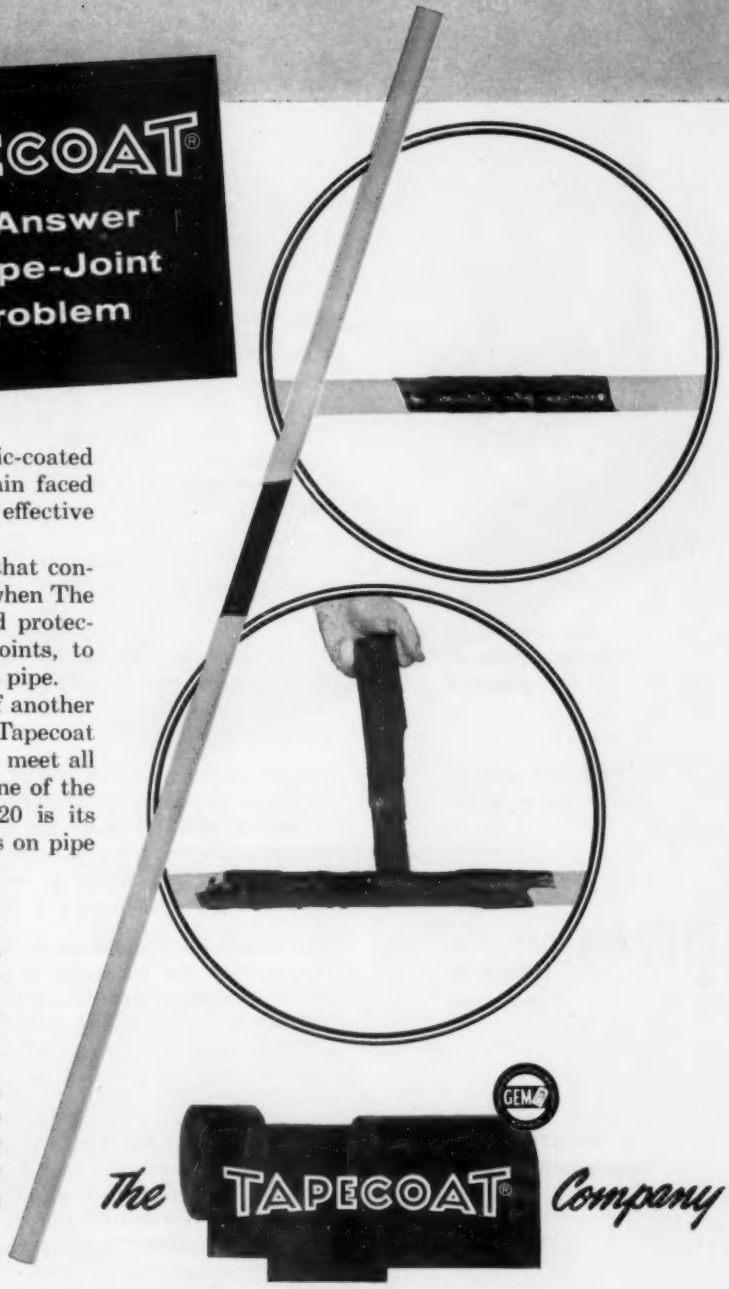

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GAS HIGHLIGHTS

Voters nix Houston Corp. franchise

In a hot gas issue, voters of Miami, Fla. turned down a 30-year franchise to The Houston Corp. The company now serves gas there on a year-to-year basis. City Fathers are in a dilemma; they wanted the 6 per cent franchise tax for the village coffers—which would have been about $40,000 in 1961. Houston Corp. feels it will be difficult to finance improvements in the old system it purchased from Florida Power & Light Co. without a franchise. Glory-seeking, but misguided, young JayCees trying to use the franchise as a blackjack to force the utility into lower rates were prime protestants. Out of 123,000-plus eligible voters, only about 8000 voted. Houston Corp. paid $16,000 for the special election, or about $2 a vote. Election was held Feb. 7. Florida PUC has yet to set final rates for the utility.

Who say's it's getting warmer?

The New York Academy of Sciences says it is, that's who. Comparisons of records for 50-year periods (1851 to 1900 and 1901 to 1950) show without doubt that Grandpa was right when he said the winters aren't what they used to be. The fact that New Yorkers, including the scientists of the academy, were chest-deep in snow when the information was released is not considered significant. On the average, winters were colder between 1851 and 1900, than between 1901 and 1950—and summers were cooler, too. The only variance to these statistics is the area around the Falkland Islands—off the tip of South America. It's getting colder there. Anyone for a pipeline to the Falklands?

Big Canadian storage project planned

Imperial Oil Co. has a program to develop underground natural gas storage in southwestern Ontario. It will be closely integrated with Trans-Canada Pipe Line Ltd. and will help cut gas prices to utilities and pipeline companies. Union Gas Co. of Canada has the only other eastern Canada gas storage operation.

FPC lost ground on cases in '60

The impossibility of FPC utility-type control of independent gas producers continues to become more evident to everyone—except Congress. In spite of several speed-up measures, FPC reports closing out 1960 with many more rate increase proposals from producers on hand than it had at end of year 1959. It disposed of three times more of such cases in 1960 than in 1959, yet had a net gain in those on hand.

TGT picks up a trillion in reserves

Tennessee Gas Transmission Co. purchased Pan American Petroleum's Bastian Bay, La. leaseholds to add more than 1 trillion cu ft of natural gas reserves to its tremendous system. Deliveries have already commenced. The purchase was in line with TGT's constant program of acquiring new gas reserves to keep ahead of expanding requirements of its customers. The price was in excess of $150 million. TGT will operate and further develop the field.

Industrial gas equipment shown

A select group of 650 engineers, architects and plant managers was shown the latest developments in natural gas engines in Omaha during early February. Co-sponsors were Northern Natural Gas Co. and utilities it serves on the Northern Plains. Twenty-two manufacturers displayed their products. Gas-fueled geneartors, prime movers, compressors, pumps, air conditioners and turbines were shown to familiarize industrial specialists with types of natural gas equipment available and application for their use.

Big as the heart of Texas

That's the theme of the AGA's big Oct. 1 annual convention to be held in Dallas—the 43rd annual meeting. Objective will be mobilizing for gas industry development. Gas industry people are urged to make their pre-registrations early. Write AGA right now to get in on this "Texas-sized" convention.

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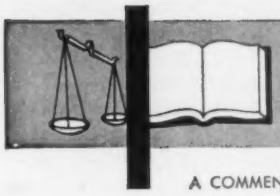


Regulatory and Legislative Trends

A COMMENTARY ON NATIONAL AND STATE DEVELOPMENTS BY AN EXPERT IN UTILITY LAW

Regulation is ripe for reform

MR. JAMES M. LANDIS is a special assistant to President Kennedy with the assignment to accomplish a reform of federal regulatory agencies in the fields of transportation, communications and energy. Mr. Landis, a former member of several federal regulatory commissions, was highly critical in his report on regulatory agencies, and his recommendations may be enacted into law. They would have a major impact on the gas industry, so management needs to know their scope to ascertain which recommendations merit support. Mr. Landis found federal regulatory agencies to be (1) lacking in established policy, (2) too slow in making decisions, (3) short of competent personnel, and (4) dominated by the industries under their regulation.

Let us examine his analysis and recommendations concerning Federal Power Commission and its regulation of the natural gas industry.

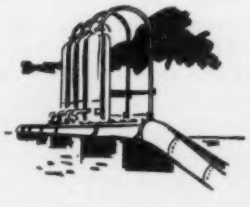
• Diagnosis of FPC Ailments

Mr. Landis first recognized the importance of the regulatory agencies by declaring that: "The scope of responsibility entrusted to these agencies is enormous, exceeding in its sweep, from the standpoint of its economic impact perhaps, the powers remaining in the Executive and the Legislative. This is true despite the fact that such powers as they exercise are generally delegated to them by the Legislative. This delegation followed upon the conviction that the problems in a particular area were so manifold and complex that the Congress simply had neither the time nor the capacity to handle them. Similarly the delegation to them of adjudicatory powers stemmed from the conviction that the issues involved were different from those that theretofore had been traditionally handled by courts and thus were not suited for judicial determination. These delegations once made are rarely recalled or retracted; on the contrary, the tendency is to expand them as more and more complex problems arise. The legislative standards under which the delegations are made are similarly increasingly loosened so that not infrequently the guide in the determination of problems that face the agencies is not much more than their conception of the public interest."

* * *

"It must be remembered that we cannot regard our government as simply a government of laws and not of men, but rather a government of laws by men. Although the mechanisms we create for administration may be more or less well adapted to a particular task, the individuals that operate them singly or as a group have the ultimate responsibility of guidance and control.

"The results of their operations will thus reflect not only efficiency or inefficiency but more importantly the ideals and goals that within the framework of the basic law can fairly be achieved."



According to Mr. Landis, unreasonable delay is prevalent in proceedings before the commissions. Some delay was caused by insufficient appropriations to staff for the workload. The *Phillips* decision of the Supreme Court caused a flood of producer rate filings with FPC. It would take 13 years for FPC to decide the pending 2313 gas producer rate cases with its present staff by using traditional methods. The new area pricing approach, however, may speed up cases. Mr. Landis criticized FPC for waiting for legislation to overcome the *Phillips* decision and said: "The bills, however, were vetoed on two occasions and the problem in an immensely exaggerated form still rests on the door step of the commission, since rate increase has now been pancaked upon rate increase. The consequences of this inaction have been serious, particularly to the individual natural gas consumers since, unlike the large industrial consumers, they cannot easily convert to a cheaper fuel and thus benefit from the restraint placed upon rising prices to industrial consumers by the existence of competitive fuel prices."

Originally it was thought that administrative proceedings would cost less than the old method of using the courts. Mr. Landis was shocked by the costs of transcripts, exhibits, expert witnesses such as engineers and accountants and the lawyers' fees. He said that the latest *Phillips* rate case before FPC included 76 lawyers for 33 parties and consumed 82 days of hearing plus two days of oral argument, and that it must have cost millions.

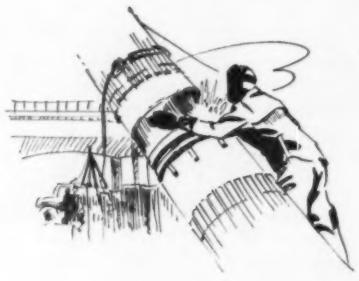
About the shortage of competent personnel in the regulatory com-

missions, Mr. Landis said: "It is generally admitted by most observers that since World War II a deterioration in the quality of our administrative personnel has taken place, both at the top level and throughout the staff.

"The causes for this are complex. The years since 1946, despite the Korean War, have been years of relative complacency as contrasted with the period from 1933 to 1941. The fires that then fed a passion for public service have burned low, making recruitment an increasingly difficult task. Careful scrutiny of agency members from the standpoint of their qualifications as well as their prejudices in behalf of administering the legislative goals to which they were to be committed, was during these years too often replaced by a consideration of what political obligations could be repaid through appointments. The area of so-called Schedule C appointments, free from Civil Service requirements, was increased affecting seriously the morale of those persons who looked upon government service as a career. Advancements to choice positions were also less rarely made from the staff. Instead outsiders not infrequently less qualified were appointed to these positions.

"These attitudes have had a serious impact upon the regulatory agencies. At the top level initial expertise would be lacking and the want of devotion to the public service militated against its acquisition through continuing tenure. Top administrative positions appear to have been sought frequently as stepping stones to further political preference or to positions of importance within the industries subject to regulation. A too common complaint at the bar is that the staffs have captured the commissions and that independent and bold thinking on the part of the members of these agencies is absent. These factors in turn reacted upon the staffs. Lacking challenges for creative effort, recruitment of outstanding younger men lagged perceptibly."

The torrid subject of ethical conduct was treated in the Landis report thus: "Much attention has recently been centered on efforts, unfortunately too frequently successful, to sway the judgment of the members of regulatory agencies by so-called *ex parte* approaches or arguments, usually personalized, made off the record in proceedings that should be decided on the record. The extent of these *ex parte* approaches has only partially been revealed. They come from various sources—the office of the President, members of the Congress, and the regulated industries. Some are made in good faith; others to further a personal desire regardless of the public interest. Many of them emanate from lawyers striving to press their clients' cause, indeed, one of the worst phases of this situation is the existence of groups of lawyers, concentrated in Washington itself, who implicitly hold out to clients that they have means of access to various regulatory agencies off the record that are more important than those that can be made on the record. These lawyers have generally previously held positions of more or less importance in the Government."

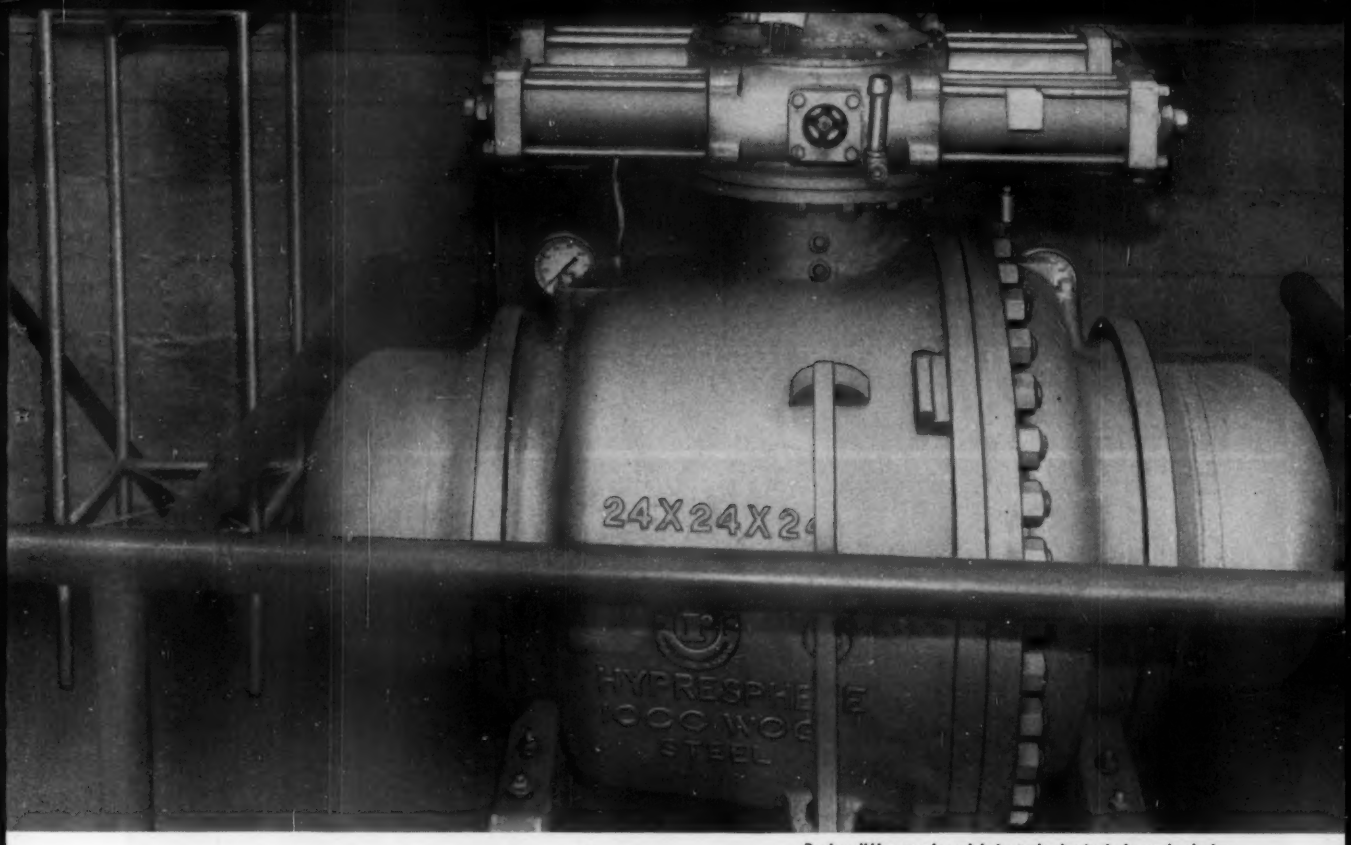


Administrative procedure has contributed to the slow processing of cases. The combination of the functions of prosecutor and judge, especially in the hands of laymen, developed a belief before World War II that the regulatory agencies were not assuring fairness. The Landis report states: "Beginning about 1938 concerted efforts were made to deal with these problems. At the outset, spurred on by an antagonism to the very powers exercised by the regulatory agencies, the bar as a whole sought to impose the straight-jackets of traditional judicial procedure on the agencies. They were countered by other forces which sought to retain the value of the administrative process but still advocated reforms that would assure fairness in the exercise of powers delegated to the agencies. Some eight years thereafter a compromise between these two opposing views was effected by the enactment of the Administrative Procedure Act of 1946. That Act, however one may evaluate it, is far from a definitive solution of the problems with which it dealt. It has achieved some uniformity of procedure, some assurance of the application of fairer standards, but with its emphasis on 'judicialization' has made for delay in the handling of many matters before these agencies." * * *

"Very recently suggestions have been advanced that due to modern techniques for the assemblage of facts, the older 'judicialized' forms may well be supplanted. The exact technology applicable to such a process has not as yet been clearly articulated. But if judgments of regulatory agencies in many fields such as rates are, in truth, business judgments rather than judgments conforming to a legal theory, techniques which do not rest upon the tedious process of examination and cross-examination and which underlie honest business judgments made by the industries may have a value in the handling of substantially the same problem by the agencies."

Treating with Administrative agency organization, planning, policy functions, and decisions, Mr. Landis asserts: "Unlike the judges of the federal judiciary, members of administrative commissions do not do their own work. The fact is that they simply cannot do it. In adjudicatory matters, the drafting of opinions is delegated to opinion writing sections or assistants so that the rationalization upon which a purportedly informed decision rests is not truly their own. * * * But worse than this, it is a general belief, founded on considerable evidence, that briefs of counsel, findings of hearing examiners, relevant portions of the basic records, are rarely read by the individuals theoretically responsible

(*Continued on page* 123)



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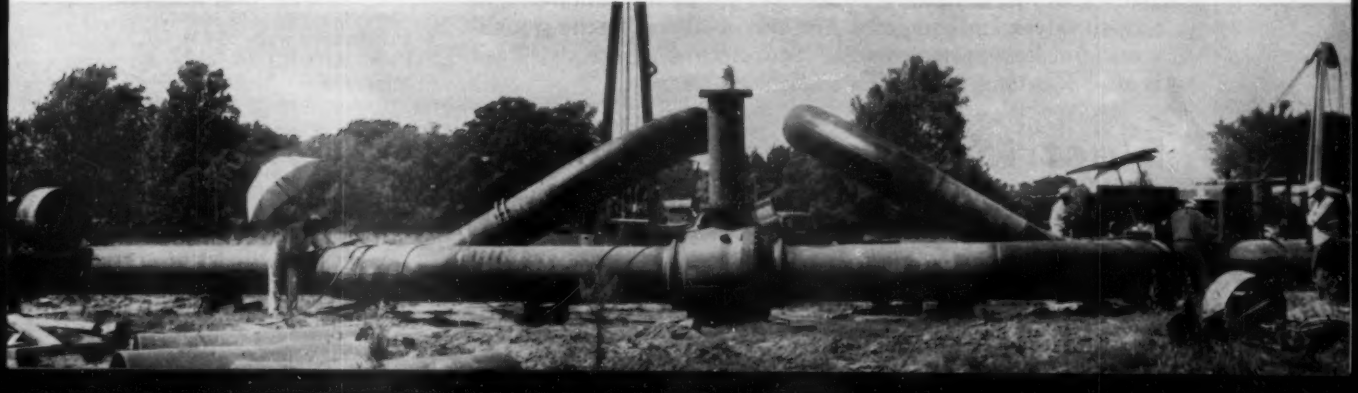

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TECHNICAL TRENDS

By GUY CORFIELD
Professional Engineer,
Los Angeles

New means for fire extinguishment

A fire is extinguished by lowering temperature of the burning material below its ignition point, or blanketing it with a liquid or vapor to exclude air and prevent continued oxidation. It is preferable to accomplish both effects simultaneously.

Water is the favorite and most readily available means, but it cannot be used for electrical fires. In some cases, it will spread rather than suppress oil fires. Attempts have been made to "improve" water as a fire fighting agent by making it "thicker" or more viscous, and opaque. Thus it would stay in place longer and make a more effective blanket. It would also lower radiation of flames which helps them to spread. An effective thickening agent is a sulfonated polyvinyl toluene developed by Dow and called ET400-4. Aluminum powder appears to be the best opacifier or radiation reducer.

Frequent use is made of foams —organic-metallic liquids—which when aerated produce a dense and stable foam acting as a blanket to smother fire by exclusion of air. Carbon dioxide gas, discharged from cylinders, also smothers fire by depriving oxygen.

In the liquid chemical class, carbon tetrachloride has been a favorite type of extinguisher, particularly for electrical fires. It has the disadvantage of being quite toxic both in its original vapor state and when decomposed by heat. An examination of other halogenated hydrocarbons has disclosed that bromotrifluoromethane ($C Br F_3$), also known as halogen 1301, is much more effective as an extinguisher than carbon tetrachloride, and also much less toxic.

Extensive use is also made of dry powders. The major constituent is sodium bicarbonate which decomposes with heat to release carbon dioxide. Recently it was found that potassium bicarbonate is about twice as effective as sodium bicarbonate. No very satisfactory chemical explanation has been advanced. A commercial powder consisting essentially of this potassium salt is on the market under the name of Purple-K—this name being given presumably because potassium gives a purple color to flame.

There are a number of special powders used to extinguish or control burning metals such as magnesium, titanium and sodium. One is G-1, a trade name of the Fyr-Fyter Co. It is granular graphite and phosphorous compounds. When applied to burning metal, vapors are emitted which exclude air, and conducts heat away rapidly.

Another powder is Met-L-X, produced by Ansul Chemical Co. It is basically sodium chloride with additives that give it free-flowing and then caking properties so that it envelopes burning metal in a smothering crust.

It can be seen that fire fighting techniques have been explored through careful research and with considerable ingenuity.

Versatile mass spectrometer

The mass spectrometer, originally capable of analyzing gases and volatile liquids, has now been developed into a much more flexible instrument by Consolidated Electrodynamics of Pasadena, Calif. It is commercially available as Model 21-110 at a cost of approximately $100,000. It is said to be able to analyze solids including metals, in addition to gases and liquids. It has a mass range of 2 to 2000. Fexibility is attained through a double focusing mass resolving system.

To analyze a metal, samples are clamped between electrodes across which a radio frequency spark releases ionized molecules into a mass resolving system. An electron bombardment source is used for gases and liquids. Its new capabilities are said to include exploring the structure of high molecular weight molecules such as in polymers and greases; identifying and measuring concentrations of unknown materials in a substance; and disclosing trace impurities and components that are so important in semi-conductors.

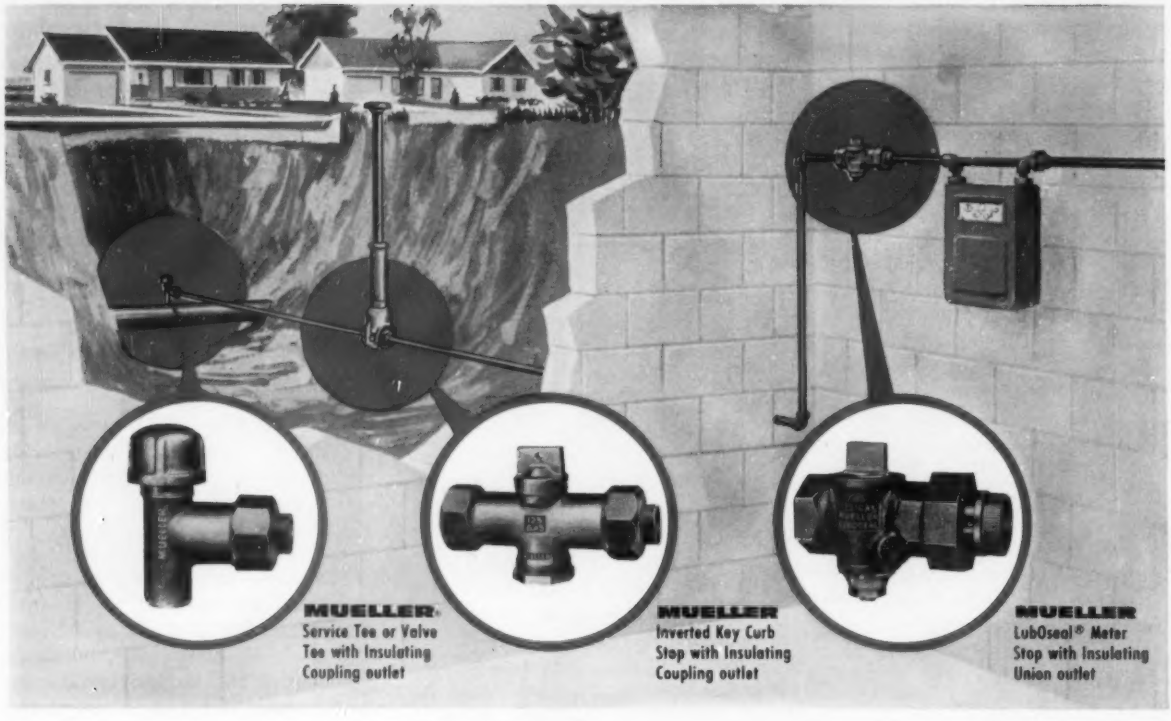
Oil Recovery By Alcohol "Flooding"

A 5-company group of oil field operators in the Bradford field, Pennsylvania, has gone beyond pilot plant experiments to start full field scale work to recover residual underground oil by alcohol "flooding." By flooding is meant pressure injection of liquid into the formation to force or "drive" the residual oil through the sands and out of the formerly producing wells. Bradford field is one of the oldest in the U. S., having been discovered in 1871. The alcohol operation is actually tertiary recovery, as secondary recovery with water injection was used (also as a pioneer venture at that time) about 1900.

Prior production from the field has been 605 million bbl, but it is estimated that 52 million bbl still remain. Some 27,000 bbl of alcohol (crude iso-propyl costing $10.50 per bbl) will be injected at a rate of 100 bbl per day, at 1100 psig to a depth of 1400 ft, through 4 wells. It is expected that this alcohol will mix with and displace both the oil and water now underground. More water will then be injected, to force the mixture out of the production wells. Presumably the alcohol can be recovered by a simple distillation process.

stop electrolytic corrosion

at the main
at the curb
at the meter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WASHINGTON

By NEIL REGEIMBAL

GAS Washington Bureau
1093 National Press Bldg.
Washington 4, D. C.

Tightening of controls in first stages

TIGHTENING government controls over the natural gas industry is in the first stages. Courts, Congress, and the White House are building this trend.

The new Kennedy Administration won't waste too much time in seeking: A reduction of present 27½ per cent gas and oil depletion allowances; a national fuels policy with end use controls on natural gas; and, tighter controls over regulatory agencies such as the FPC.

Sources inside the new Administration freely admit these plans. The President himself has told reporters to "watch the next two months," although he refuses to predict a "100 days."

Depletion and fuels policy actions will come swiftly.

In Congress, leaders in the Democratic majority say they are ready to push through these programs, along with the President's housing, education, farm, and depressed areas programs before any bloom on the new Administration has a chance to fade.

Reform and reorganization of regulatory agencies will take longer, as will any depletion action. The regulatory agency program will have to be tailored to about a half-dozen different agencies, each with somewhat different problems. Depletion changes will have to wait completion of a massive "tax reform" measure to be drafted this year and next.

Here are the highlights of early activity in these fields:

Fuels policy—In the first few days of the new congressional session—even before the new President was inaugurated—more than two dozen bills were introduced calling for a fuels policy study. Most called for creation of a joint Senate - House committee. This group would hold hearings, particularly in the coal areas, and eventually draft a national fuels policy to be adopted by Congress. There is little doubt that prohibitions on so-called "dump sales" of natural gas are a prime object of the study, although the initial bill setting it up will probably not specify this in any way. Support for a "realistic" fuels study by the American Petroleum Institute and the Independent Petroleum Association of America makes passage virtually certain.

Depletion — The new Treasury Secretary, Douglas Dillon, says he is "open minded," but admits that the time has come for a "full study" of the depletion controversy. Among the new powers in Congress are many who have been long and bitter foes of the present depletion rate. At least three top officials of the new Administration—the chairman of the President's Council of Economic Advisors, the new "overseer" of regulatory agencies, and the new Interior Secretary — have all opposed the gas-oil depletion rate at one time or another.

Regulatory agencies—Three separate studies in the early days of the new Congress lashed the regulatory agencies, particularly the FPC. One was made at the special request of the President by James M. Landis, who later was named special White House "overseer" of these agencies. Suggested actions include bigger budgets, more power for hearing examiners, and tight controls over industry-agency contacts. Rep. Oren Harris (D., Ark.) reintroduced his proposal to bar most contacts between industry and agency officials on pending cases early in the year.

Defeat hangs heavy

GAS bill supporters are warming up for another battle. But like the defenders of the Alamo, defeat hangs heavy in the air as battle lines are drawn.

Rep. Oren Harris (D., Ark.), chairman of the House Commerce Commission and perennial gas bill sponsor, started the firing early. He reintroduced on the first day of the new session of Congress his bill of last year, the principal effect of which would be to substitute commodity-type regulation for present utility (cost) type controls.

Not long afterwards, the so-called gas industry harmony group began meeting to prepare a unified support of this or some very similar measure — one without the coal-sought "anti - dumping" provision. The group is so-named because it is made up of all three segments of the industry, and designed to prevent the type of intramural feuding over gas legislation which has so badly hurt the drive in the past.

The FPC, in its annual report, again asked that Congress substitute commodity value for the utility approach. It also requested Congress to officially authorize the present area pricing system, which the FPC instituted on its own late last year.

Rep. Harris' bill does contain the coal "dump sale" prohibition,

(*Continued on the next page*)

requested by the coal industry and opposed by the gas industry.

The Congressman says he has no plans to start hearings on his measure or any other gas bill until the gas industry shows united support for a measure, and until the gas and coal interests at least attempt to agree on a solution to the industrial sales controversy. Once again, the Arkansan grumpily complains that the industries involved do not give him the support needed to push through the measure.

Meanwhile, the U. S. Supreme Court has thrown another bomb into the industry's battle lines. The high court ruled that the FPC has authority to consider the "end use" of gas even though it is purchased in the field by a consumer and is not resold. It upset lower courts and handed the coal industry a victory.

The court ruled that the commission had the power to refuse to issue a certificate to Transcontinental Gas Pipe Line Corp. to transport gas for Consolidated Edison Co. in New York from Texas.

"Consistent with the congressional purpose of leaving 'attractive gas' in regulation, we must conclude that the 'end use' factor was properly of concern to the commission," the court majority said in an opinion delivered by Chief Justice Warren.

The FPC had originally refused to grant the transportation certificate because of an "inferior use" of the gas, which would be used to fire steam boilers by the electric utility. It has no control over the gas sale, but does over the transportation. Lower courts, however, ruled that the FPC was outside of its authority in using this as a basis for rejecting the certificate application.

A court minority dissented in part from the Warren decision. It agreed that the Natural Gas Act "supports the commission's power to consider inferior end use as a factor in denying Transco a transportation certificate."

But it did not agree that fears by the FPC of price increases and preemption of line capacity for boiler fuel use were "adequate to support the refusal." Thus, the minority apparently believed the commission was using the end use as an excuse to block direct purchases in the field by utilities and industrial users to force more normal sale-resale arrangements.

This decision thus gives the FPC new powers to control end use of gas. What the coal people need now, spokesmen say, is simply a congressional directive to the FPC to require it to act on this power to limit industrial sales.

Gas bill opponents lost no time in attacking the measure. Democratic Congressmen John Moss of California and John Dingell of Michigan opened the defense by charging that indefinite pricing clauses permitted by the Gas Act are "indefensible, immoral and inflationary." They proposed legislation to flatly outlaw all escalation in gas contracts, and argued that these clauses are only supported by persons "who do unjustly profit by their operation." Their proposal would also bar rate increases before a previous increase has been approved.

FPC vacancy fight

President Kennedy filled the two vacancies on the Federal Power Commission, and immediately started a toe-to-toe slugging match with the chairman, Jerome Kuykendall.

President Kennedy named, subject to Senate confirmation, Joseph C. Swidler, Nashville, Tenn., lawyer and former Tennessee Valley Authority official, and Howard Morgan, a former Oregon Public Utility commissioner.

Both are considered strong advocates of the "consumer interest" approach to gas and electric regulation.

The President in naming the two said that Swidler would be the new chairman. Kuykendall shot back that the law does not permit the chairmanship to be changed, and he intends to keep the job. He has a legal ruling to this effect, and the White House indicated it would fight it out, but admitted it would be an uphill battle. Chairman Kuykendall's term ends in 1962.

In spite of the two Democratic appointments, the Republicans will keep their majority on the commission until June, when Commissioner Kline's term expires.

Swidler, 54, was appointed to a term expiring in 1965. This is the seat which has been vacant since last year when the Senate refused to confirm Eisenhower's nomination of Thomas Donegan, who declined to take a recess appointment.

Morgan's term would expire in 1963. He will replace Paul A. Sweeney, who has been serving under a recess appointment when he, too, was not confirmed by the Senate last year.

Kuykendall denies making comments

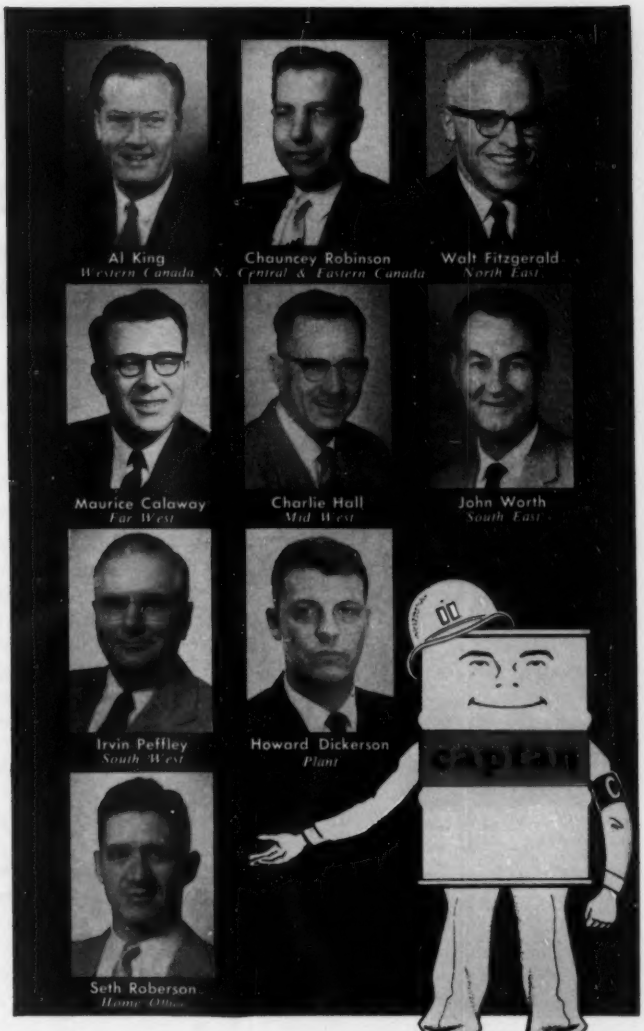
FPC chairman Jerome K. Kuykendall said he has not made any statements in connection with his future role as chairman or as a member of the agency. Kuykendall was commenting on published reports which quoted him as saying that he intends to remain as chairman of FPC. He said he has made no statement of any kind on the subject and had not expressed any views on the future chairmanship of the commission.

Fuels study bug

Former President Eisenhower caught a little of the fuels study bug as he left office.

In his final budget message to Congress, the former President asked for an appropriation of $7.1 million for the Bureau of Mines for bituminous coal research. Another $998,000 was asked for anthracite research. This was in addition to the $2 million authorized each year for special coal marketing, production, and utilization studies.

But he didn't forget the gas-oil industry. He also asked $3.3 million for petroleum research, including the beginnings of a shale oil research program. "The broad purposes of this program are to find ways to obtain a larger ultimate recovery from the nation's oil and gas fields and greater benefit to the public from oil and gas produced," the budget message said.



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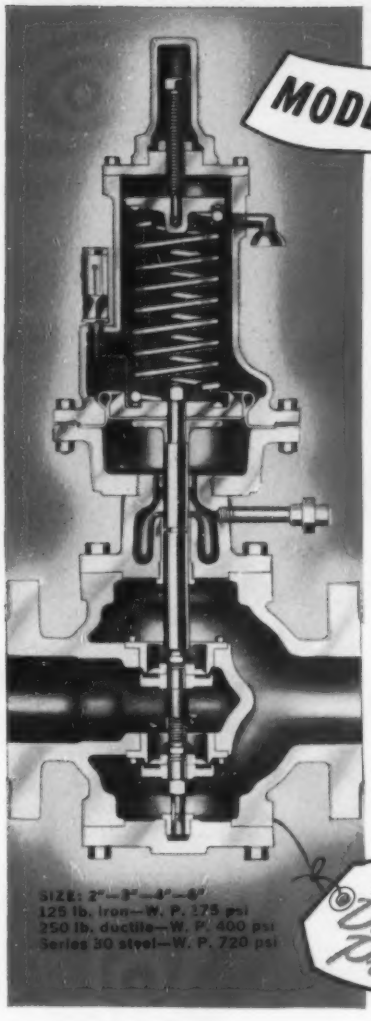

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CORROSION PREVENTION

DISTRIBUTION
TRANSMISSION

What's important?

By MARSHALL E. PARKER
Consulting Engineer, Houston

ONE thing a corrosion engineer must always remember is that some things which seem important to him do not always seem so to others. Many have had the experience of trying to run a current requirement test on a section of pipeline, only to find there is an additional, and unidentified, load on the line. Further investigation discloses an uninsulated, often bare, lateral. Inquiry then develops that "it's just a temporary line; don't pay any attention to it." Unfortunately, trying to test the line without paying any attention to the bare lateral is like trying to weigh a horseshoe while ignoring the horse to which it is attached.

There are several reasons for insulating a temporary line from the permanent line to which it is attached. First, if the permanent line is not under cathodic protection, there is a strong probability of galvanic action between the two lines. If the temporary line is new steel, it will probably act as the anode, and will corrode faster than if it were isolated. If it is second-hand pipe, there is a chance that it may make a strong enough anode to appreciably accelerate the attack on the permanent line.

If the permanent line is under cathodic protection, then connection of an uninsulated lateral will almost certainly nullify that protection over a part of the line; not necessarily because of the lateral itself, but because of what it is connected to. A line to a drilling well, for example, represents a load greater than 10 to 20 miles of coated transmission line. Why, then, deprive a line of needed protection for the sake of a momentary convenience, or to save a few dollars?

How an unknown lateral can interfere with a test has already been mentioned—and it does not have to be unknown to do this; the figure of speech used was not an exaggeration.

Finally, an excellent reason for insulating the temporary connection is that many such temporary installations have a way of lasting longer and longer. In the end they become a permanent part of the system—and they are much more difficult to take care of after installation than at that time.

Another item, importance of which depends upon the point of view, is location of test leads. During construction of a line, all points on right-of-way are, more or less, equally accessible; at least the construction crews have sooner or later to get to all of them, so it doesn't make very much difference to them where test leads are installed. Later on, when temporary access roads are no longer open, when fences have been rebuilt, the corrosion engineer, traveling in an ordinary car and with no tractors nearby in case he gets stuck, finds that it makes a great deal of difference where they are installed. One line comes to mind; about 600 miles of gas transmission line, traversing well-developed agricultural flat terrain. Specifications called for a well-designed test lead at every road crossing, of which there were many. There was no specification, however, as to which side of the crossing was to be used.

As construction got under way, the foreman in charge of test lead installation asked for instruction on this point. A snap decision was made. He was told to put the lead on the downstream side. This he faithfully did, at every crossing. The result was that at seven of the thirteen combination railway-highway crossings, the test lead is on the side of the railway *away* from the road. At six other crossings, the test lead lies beyond a deep and wide drainage ditch which is usually full of water, while the other side of the road is no problem. The railway test leads are read at each survey, although with some grumbling. Those across the ditches have not been visited as yet. Had the opposite choice been made, and all leads put on the upstream side, results would have been no better. The point is that the choice at each crossing should have been made by someone with the corrosion engineer's needs in mind.

A similar lack of imagination—again in the field of insulation—leads to installation of gauge lines, electric conduit, gas operating lines, and other short-circuiting metallic elements around insulated joints, thereby nullifying their effectiveness. Very often these details are not even shown on piping diagrams. Thus, being out of sight, they are effectively out of mind.

The writer knows of one case where a gas line is shorted to large plants at both ends by small piping associated with gas - operated valves. The piping diagram does not show this small piping, and does not even identify the valves as being gas - operated; consequently, installation of insulating material in the flanged joint on the *plant end* of each valve was approved before construction. Had it been placed on the other end of the same valve, it would have served its intended function. This condition has operated for six

(*Continued on page* 180)

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THE GASSING GAME

By **JIM CLARK** • Gas & Oil Consultant, Houston

COST of service regulation of gas producers is going to put high cost, expensive natural gas into INTERSTATE lines and direct the cheaper gas into INTRASTATE commerce.

That logical conclusion is being demonstrated in Texas today more than ever before. For instance, in the Houston area there is a battle on for industrial gas sales. Within recent weeks Pan American Production Co. has been moving in on large industrial loads that have been served by Humble Oil & Refining Co. and other companies for years.

In San Antonio, United Gas Corp. has apparently lost the city business to a new entity known as Alamo Gas Co., composed of a group of independents. There are other evidences all over Texas of this movement to get the lower price gas into intrastate market while leaving the higher priced gas for the interstate pipelines.

The simple route to these local gas market changes is lower price. In fact, it is possible that Texas will see this gas price-cutting trend extend in the years to come. The reason is simple. There just isn't as much profit in selling cheap gas into a price-controlled interstate market.

The result is bound to be a continuing growth in intrastate gas sales, probably to the extent that the state and the many larger municipalities and counties in Texas will join in an advertising campaign designed to attract industry as well as new citizens to the state. This campaign will include Texas' foremost industrial and heating attraction, cheap natural gas.

In the meantime gas sales to intrastate outlets is almost certain to continue to climb as long as the government holds to the cost of service philosophy in gas producer regulation. There is simply no other way from an economic standpoint.

William J. Murray, highly respected member of the Texas Railroad Commission, bore down on this point recently when he told the Society of Petroleum Engineers in Houston that some basis other than producer's cost of service must be devised for fixing wellhead prices for natural gas.

"I have been opposed to minimum price statutes in our own state, just as I have been opposed to price ceilings by the Federal Government, on any commodity which is competitively produced whether it be beef, cotton, wheat, or gas. But if this philosophy cannot prevail, and if Congress and the Courts determine that wellhead price of gas must be fixed, then, for the protection of the consumer, if for no other reason, some basis other than producer's cost of service must be devised for fixing wellhead price," Murray said.

"Cost of service, if applied to the rancher in time of drought, might result in beef at five dollars a pound; and, for the unlucky or inefficient producer, it could mean one-dollar per Mcf for gas at the wellhead. Cost of service price fixing, as the Federal Power Commissioners have pointed out, would ultimately cause gas reserves with lower cost to remain in intrastate commerce, and only the gas with high cost would go into interstate commerce," said Commissioner Murray.

Murray told the engineers that producers cannot be treated as utilities because of the inherent risk involved in the requirement for venture capital. He said that to attract such capital there must be the possibility of much greater than six per cent return. But he added that in order to protect consumers from the high prices that would result from inefficiency, waste, poor judgment, or just plain hard luck, gas producers cannot be guaranteed against loss. He said that when a gas producer spends large sums and produces poor reserves he is not entitled to six per cent. In fact, Murray added, he is not even entitled to his money back.

The Texas Commissioner said he thought possibly the area pricing idea was a step in the right direction but added that he believed somehow and somewhere a sound and sensible solution could be found to the present natural gas producer regulation dilemma.

Bill Murray is a remarkable public servant. He was raised in the oilfields and educated as a petroleum engineer. He was appointed to the Railroad Commission post after serving as the regulatory body's chief engineer for several years. He has been re-elected several times by overwhelming votes. He is also a former Federal government conservation engineer. His friends say Murray is a poor politician, but his record belies this because even when he once wanted to go into another field, the citizens of Texas petitioned him to remain where he could be of greater service to the public.

Federal gas controls could be an important selling point in a proposed statewide advertising campaign which was recently authorized by an amendment to the Texas constitution. ■

WHY PLASTIC PIPE USAGE IN GAS DISTRIBUTION IS SHARPLY ON THE INCREASE

1. *Since no expensive wrapping procedures are required, plastic piping costs less initially.*

2. *Fewer men require fewer costly hours to install lightweight, easy-to-join plastic piping systems.*

3. *Unlike metallics, plastics won't corrode thus decreasing the volume of unaccounted for gas.*

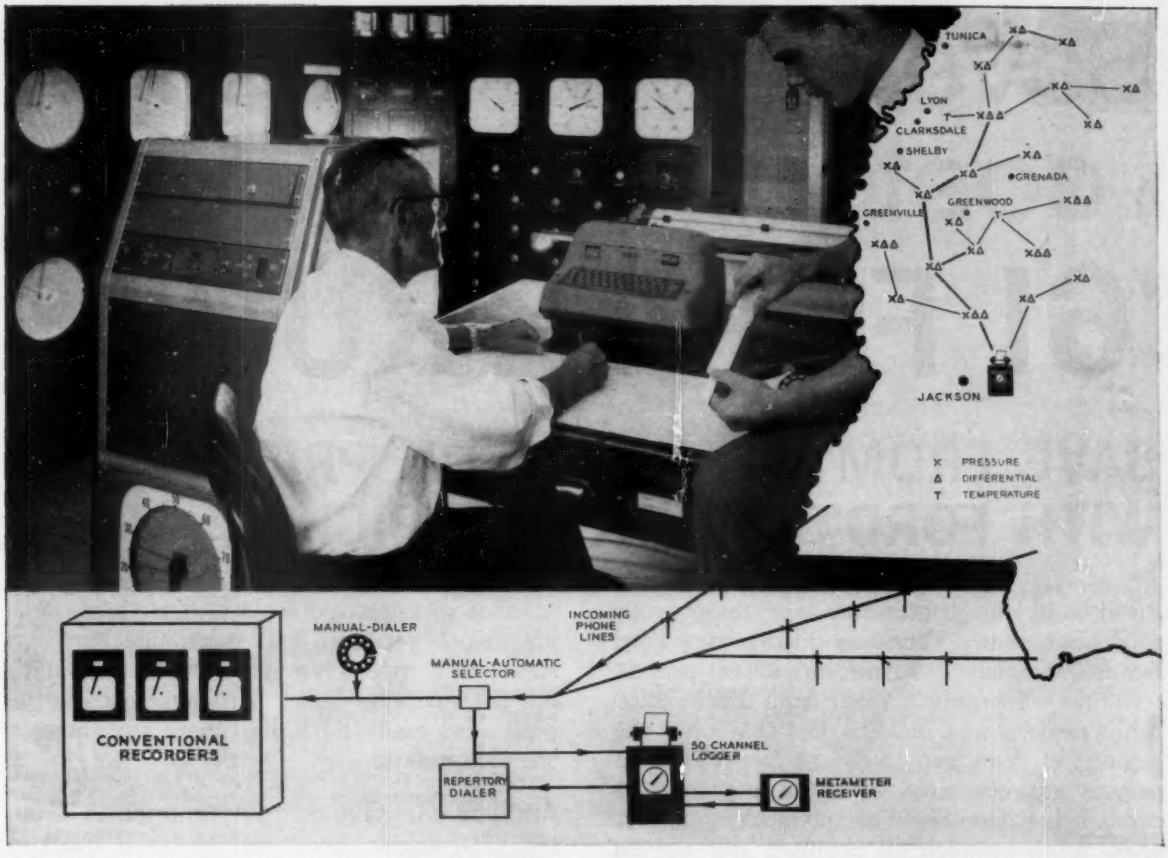
4. *In the years after installation, service replacements are fewer with non corrosive plastic.*

5. *Rate of gas flow is greater with plastics due to the smoother, less inhibitive pipe walls.*

Kraloy/Chemtrol* would like to assist your company to evaluate initial or further use of plastic distribution systems. Our experience and research facilities are available to you. Also you may wish to see our latest, full-color motion picture dealing exclusively with plastics in the gas industry. Write on your company letterhead to:

Kraloy / Chemtrol Co.*, 402 W. Central Ave., Santa Ana, Calif.

*FORMERLY KRALOY PLASTIC PIPE CO.



Bristol Metameter* Telemeters (on panels) and Data-Master* digital data logger (foreground) in central dispatcher's office of Mississippi Valley Gas Co., Jackson, Miss. The Data-Master automatically types out instrument readings from points shown on map. (Punched-tape output also available.) **T. M. Reg. U. S. Pat. Off.*

Big change at Mississippi Valley Gas:

Digital Data Logging by Bristol

Amazing boost in telemetering efficiency, economy, and system control effected by "Data-Master" digital data logging.

The Bristol Metameter* Telemetering system at Mississippi Valley Gas Company was already one of the most extensive systems of its kind. At the spin of a telephone dial, the dispatcher, at Jackson, Mississippi, could receive pressure, flow, or temperature readings—49 functions in all—from 21 stations, up to 200 miles away.

Today there's an even greater advance in this outstanding system: "Data-Master" digital data logging equipment, manufactured by Data-Master Corporation, a Bristol subsidiary, has taken over the routine dialing and recording of data. As often as three times an hour, the Data-Master equipment *automatically* "dials" the remote stations (see map), and *automatically* types out the instrument readings on an electric typewriter. All without an instant's attention by the dispatcher. What's more, any time the dispatcher wants a specific reading, he can still manually dial any station for the reading.

Easy avoidance of contract penalties on purchased natural gas, efficient operation at near capacity, ability to give long notice to users classified as "interruptible" (allowing them to switch to standby fuels), freedom of skilled operators from the tedious routine of manually recording instrument readings (and avoidance of errors) are just a few of the benefits reported by Mississippi Valley Gas.

Bristol offers a complete telemetering systems engineering service to natural gas pipelines and distribution systems, oil pipelines, electric power systems, water plants, and industrial plants. Our engineers will welcome an opportunity to discuss your specific telemetering problems, or we'll send you literature. Write: The Bristol Company, 119 Bristol Road, Waterbury 20, Connecticut, a Subsidiary of American Chain & Cable Company, Inc. O.38

BRISTOL...for improved production through measurement and control

ACCO

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Save on construction costs with the new '61 FORD TRUCKS

SAVE FROM $22 TO $260 ON PRICE* ALONE WITH FORD'S ECONOLINE PICKUP

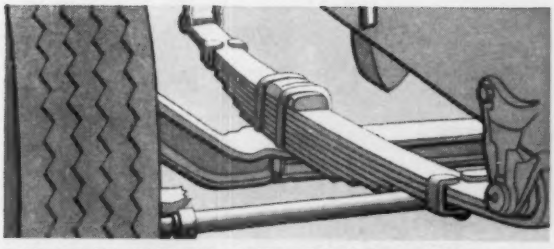
Profit-conscious contractors are finding it's good business to do business with the new Ford Econoline Pickup. It's America's lowest-priced* ½-tonner—bar none! Priced from $22 to $260 below conventional pickups. But that's just the beginning! You get lively performance and proven gas economy with the popular 144 cubic inch Falcon Six. This modern engine goes 4,000 miles between oil changes, and has an aluminized muffler which lasts up to three times as long as ordinary mufflers.

And you can save more because Ford's functional design has pared away 1,000 pounds of dead weight, yet you still get the payload capacity of standard ½-tonners. The big 7-foot box provides a whopping 73 cubic feet of loadspace . . . that's up to 23% more than conventional 6½-foot pickups. A full 49-inch tailgate opening means you can load items like standard sheets of 4′ by 8′ plywood. And the full-length *flat* floor permits bulky or heavy loads to be positioned easily by sliding them anywhere in the pickup box.

And you can save on maintenance expense, too. The engine cover can be lifted quickly, exposing the entire engine for rapid service. Spark plugs, distributor, etc., are conveniently located to speed engine tune-ups. And many major repairs can be made without ever removing the engine. One-piece cab-and-body construction provides increased rigidity and eliminates a major source of rust. In addition, all main underbody structural members are heavily zinc-coated to resist rust and corrosion.

New Ford Econoline ½-ton Pickup. Big 7-foot box with flat floor and 73 cu. ft. of usable loadspace. 1,650-lb. payloads with 4,350-lb. maximum GVW.

*Based on a comparison of latest available manufacturers' suggested retail delivered prices



SAVE UP TO $250 ON FRONT TIRES! In certified tests of two-ton truck suspensions, Ford front tires lasted over twice as long. In 40,000 miles this saving can add up to $250 . . . more as the mileage increases. And Ford's sturdy I-Beam front axle and leaf-spring suspension not only cut tire wear, but their simpler design also cuts maintenance costs.

12,000 MILE OR 12 MONTH WARRANTY

SAVE WITH GREATER DURABILITY . . . on all 1961 Ford Trucks, each part, except tires and tubes, is now warranted by your dealer against defects in material and workmanship for 12 months or 12,000 miles, whichever occurs first. The warranty does not apply, of course, to normal maintenance service and to the replacement in normal maintenance of parts such as filters, spark plugs and ignition points. Never before have you had such protection . . . such evidence of long-term economy!

SAVE WITH FORD'S NEW 262-CU. IN. "BIG SIX" ALL-TRUCK ENGINE FOR TOP PERFORMANCE AND ECONOMY

America's lowest-priced* medium-duty tilt-cab models now offer a big 262-cubic-inch Six with the power of big displacement, the gas economy of 6-cylinder design, plus the durability of heavy-duty construction. This engine features a sturdy stress-relieved head and block, strong forged steel crankshaft, long-lasting stellite-faced intake and exhaust valves and durable pyramid-type connecting rods. Positive Crankcase Ventilation reduces oil dilution and sludge formation to extend engine life. Ford's proven 292 V-8 and 292 HD V-8—the V-8's with "six-like" economy—are also available for your special power needs.

The popular Ford Tilt Cab Series outsells all other makes and for good reason! Their compact 82-inch BBC permits longer bodies within a given over-all length . . . for longer loads of lumber and building materials with excellent maneuverability. And set-back front axle design means more weight is carried on the front axle for greater payloads.

You also save with other new features like the stronger radiator with new lock-seam construction, and color-coded printed instrument panel electrical circuits that provide for greater reliability and simplified maintenance. In addition, Ford's parallel ladder-type frame, with standard 34-inch width, allows you to install new or transfer your present special construction bodies quicker and for less.

FORD TRUCKS COST LESS

YOUR FORD DEALER'S "CERTIFIED ECONOMY BOOK" PROVES IT FOR SURE...

FORD DIVISION, *Ford Motor Company*

customer quickly and easily turns stop off...

...but only the gas company can turn stop on!

positive control of home service turn-ons!

Here's a brand-new LubOseal gas meter stop that gives you positive control of home service turn-ons.

The customer can quickly and easily turn the stop "off" with a common wrench. But he can not turn it "on" with *any* tool normally found in the home. A special wrench, available only to the gas company, must be used to turn the stop to the "on" position.

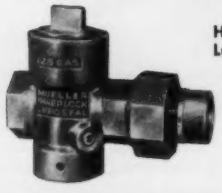
This unique design simply and effectively prevents the customer from creating a dangerous situation in the home. After turning off the gas to install an appliance—or in an emergency, the customer must call the gas company to have the gas turned on again. *After the gas company employee knows it is safe to do so,* he quickly restores service with a twist of the wrist. This automatically resets the stop and makes it ready for future shut-off use.

The new Innerlock Stop also eliminates the need for sealing devices or padlocks when the service is turned off by the gas company. However, the stop is designed so that a wire seal may be conveniently attached to indicate that it has been placed in the "off" position by the gas company and not by the customer.

new! INNERLOCK gas meter stop

Iron Body—Bronze Key
Straight Way
Flat Head
Tamperproof
Working Pressure to 125 p.s.i.
Size—¾" only

H-11190 Innerlock LubOseal Stop
Inlet:
Inside I.P. Thread
Outlet:
Inside I.P. Thread



H-11191 Innerlock LubOseal Stop
Inlet:
Inside I.P. Thread
Outlet:
Insulating Union

ANOTHER MUELLER® LubOseal® STOP

You can be certain that you are installing an absolutely safe gas stop when you install a Mueller LubOseal Stop. The many advanced features found in all LubOseals assure you that many years from now it will be just as safe and dependable as it is today.

Gas Tight—O-ring seals at top and bottom of key absolutely prevent leakage to the atmosphere. Precisely ground key is lapped into body to prevent leakage through port. False ports in key and body protect generous sealing surfaces.

Easy Turning—Four vertical grooves in key distribute grease over **all** sealing surfaces each time stop is turned off or on. Grease is stored under pressure by O-rings for perfect lubrication over long periods. Independent port permits easy relubrication of entire stop.

Fully Tested—Each stop is individually tested before shipping in both "off" and "on" position by submerging in non-corrosive liquid and applying 125 p.s.i. air pressure.

Write for complete information and specifications.

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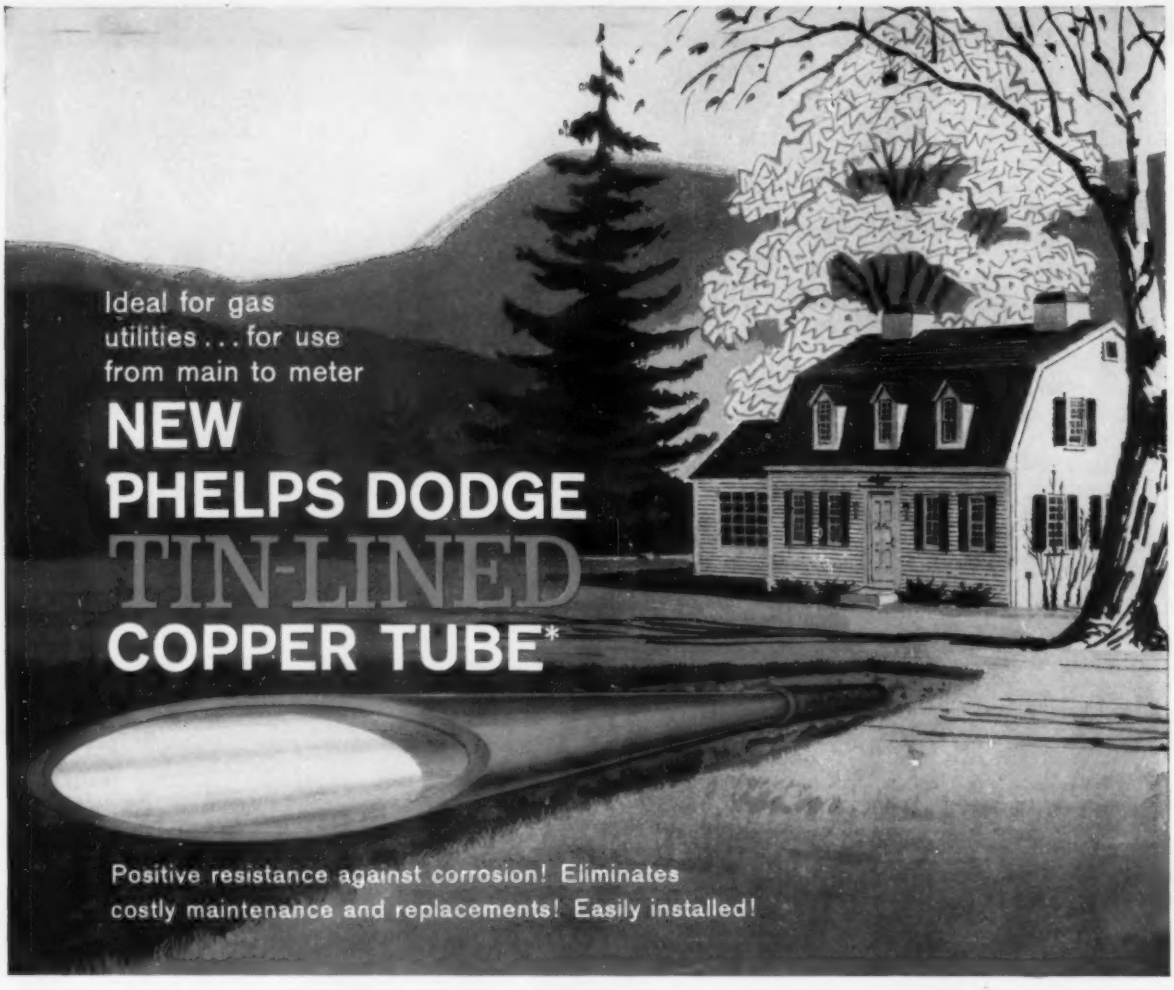
Ideal for gas utilities . . . for use from main to meter
NEW
PHELPS DODGE
TIN-LINED
COPPER TUBE*
Positive resistance against corrosion! Eliminates costly maintenance and replacements! Easily installed!

Phelps Dodge has combined the outstanding corrosion resistance of tin with the strength and ductility of copper in a new, low-cost tube that is immune to troublesome sulphur conditions found in some natural gas and petroleum products. It has special advantages for gas utilities in main-to-meter lines, LP gas lines and as instrument tubing.

The continuous, inseparably-bonded tin lining positively resists flaking action that can plug lines and orifices. The tube can easily be bent, flared or soldered, advantages that reduce labor costs. Tin-lined tube is ideal for replacement service, can be pulled through old steel or iron pipe without protective wrapping. Available in long continuous lengths and in sizes from ⅛" O. D. to 1" O. D. Other sizes are available on order. Sample and descriptive data sent on request.

Phelps Dodge tin-lined copper tube also has advantages for: oil lines; food-processing lines; beverage, pharmaceutical and water-distilling equipment; sampling lines to laboratory and control instruments.

Fusion-bonded tin lining will not crack, peel or flake when bent or flared.

*Patent pending

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FIRST FOR LASTING QUALITY—FROM MINE TO MARKET!

PD

CASE W-3 backhoe-loader works wherever you need it--any time of the year!

With both direct drive and torque-converter drive, the W-3 helps you step up schedules, cut costs, avoid delays due to bad weather

The 52 hp Case W-3 is the only unit in its work range offering the travel speed and fuel economy of direct drive PLUS the bonus power, traction and operating ease of torque-converter drive.

Fast travel to *any* job

With the W-3, you travel hard surfaces in direct drive at speeds to 19 mph. To move cross-country; ease through mud; negotiate snow, slippery slopes, move large loads — you use torque-converter drive that instantly, automatically provides the correct speed-to-power ratio for the footing.

Faster work on *every* job

The W-3 with torque-converter drive gives you an infinite number of speeds down to 0 mph — without clutching, shifting or stalling. On loader work, this cuts wheel slippage, increases traction, enables you to move more material. With the torque converter you can move the backhoe in, on and off the job — despite hub-deep mud. You can work jobs a direct drive hoe couldn't reach! For backfilling or loading, the W-3 torque converter delivers up to twice the output torque you'd get with similarly sized, direct drive units. This bonus power, plus the W-3's traction advantages, pays off in faster, smoother loading under good conditions and ability to keep working efficiently despite rain-soaked or frozen materials and bad footing.

Built to take sustained hard usage

The W-3 features Case-built gasoline or diesel engines proved in millions of hours of field use . . . 7000-lb capacity front axle . . . extra-heavy wheel bearings . . . rugged, box-section loader frame and arms . . . and a special, alloy-steel backhoe tower proved under the severest conditions.

But see the W-3 and judge for yourself how it solves your specific problems. Ask your Case Industrial Dealer to arrange for a demonstration, show you why buying on price alone is a false economy. Or write for literature to Dept C1391, J. I. Case Co., Racine, Wis.

CASE

J. I. CASE CO., RACINE, WIS.

Case W-3 backhoe digs to depth of 14 ft, offers 18 to 38-inch buckets. Loader is available with 15-cu ft to 1-cu yd buckets. Tractor features power steer, shuttle transmission with split-second forward-reverse shift. Optional attachments include blade, crane boom, forks, mowers, hitches and pto.

Also LOW-COST* CRAWLERS FOR BACKFILLING, GRADING

J. I. Case offers two easily transportable, highly productive power-angling dozers with "on-the-go" blade setting for high-speed follow-up behind trenchers, for grading and similar work.

Model 420 — 42 hp gasoline or 40 hp diesel. Also available as power-tilting or straight dozer . . . ¾-yd loader . . . backhoe-loader combination — with other equipment including sideboom and pallet or log forks.

Model 600 — 62 hp gasoline or diesel with exclusive Terramatic® transmission. Also available as power-tilting or straight dozer, 1-yd loader or loader-backhoe combination — with other equipment including scarifier, sideboom, winch, pto, and pallet or log forks.

*Prices start at $5466.50, factory list, for gasoline-powered Model 420 power-angling dozer.

CT-DB-572

Eclipse *Wedgeseal*® Union-End Gas Cocks combine shutoff with insulation... *and reduce installation costs*

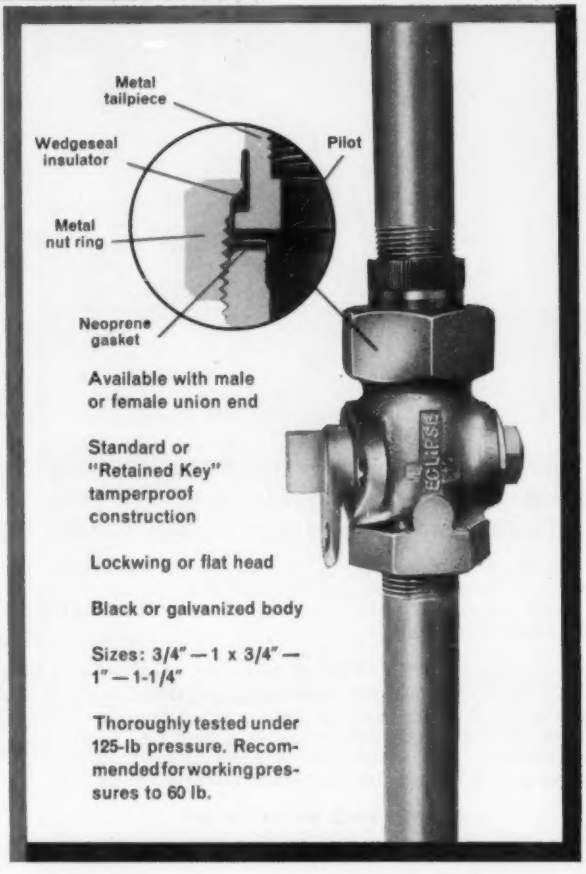
The *Wedgeseal*® insulator is integral *can't be lost or left out*

With Eclipse Wedgeseal-insulated gas cocks, you combine shutoff with insulation of mains and services against induced or stray house currents — and reduce installation costs.

The initial cost is lower than a separate gas cock plus insulating union. The number of threaded connections is reduced. Expensive on-the-job make-up time is eliminated. The pilot on the tailpiece holds gasket during assembly and retains it in use. High-compression sealing remains tight under piping strains.

The Wedgeseal insulator is integral with the tailpiece of the gas cock. It will not shear off, pull out, or crack in service — withstands over 350 ft-lb torque. The material is suitable for continuous use at 275° F and is form stable at 400° F. It is weatherproof and unaffected by natural, manufactured, or LP gas.

Performance has been thoroughly proved in thousands of installations since 1957. For complete data, write for new Bulletin 600.



Available with male or female union end

Standard or "Retained Key" tamperproof construction

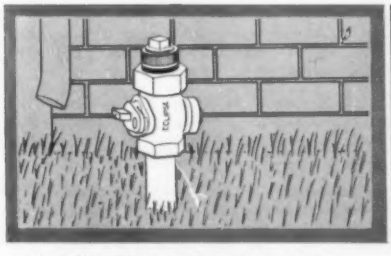
Lockwing or flat head

Black or galvanized body

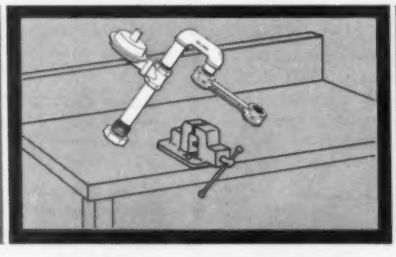
Sizes: 3/4" — 1 x 3/4" — 1" — 1-1/4"

Thoroughly tested under 125-lb pressure. Recommended for working pressures to 60 lb.

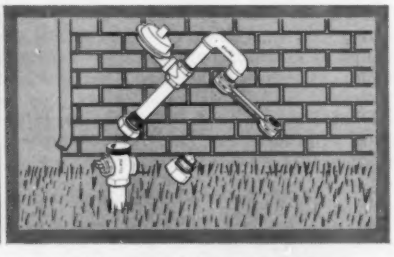
Standardized shop-controlled installations for outdoor meter sets



Install an Eclipse Wedgeseal-insulated gas cock on end of riser. Screw pipe plug into tailpiece to keep out dirt until the meter loop is attached.



Now you can conveniently preassemble and test the meter loop in your shop. Permanently install a two-thirds Wedgeseal union on the inlet end.



Install the assembled meter loop after removing plugged tailpiece from the riser. (Use the plugged tailpiece for your next job.)

Eclipse®

GAS SERVICE PRODUCTS DIVISION
ECLIPSE FUEL ENGINEERING COMPANY
1109 Buchanan St., Rockford, Illinois

Export: Ad. Auriema, Inc., 85 Broad Street, New York 4, N.Y.

SERIES 22

SERVICE AND MAINTENANCE BODIES

Four Models . . . Four Sizes

COMPARTMENTIZED TO FIT SPECIFIC JOB NEEDS

Which Series 22 Body do you need? Take a look . . . there's a model especially designed for your particular type of service work. The durable, all-steel unit shown above, equipped with an optional overhead rack, is widely used for general service work in all operations. Other models for electric, telephone and gas service have similar compartments fitted with various shelves and bins to meet specific work needs. Result: You get a custom-made body at a mass-produced price . . . plus increased crew efficiency on every job.

Series 22 Body features include flat, 16-gauge compartment tops . . . rust-proof, cadmium-plated door latches . . . nylon bushings in all door hinges . . . key-locking, weathertight doors . . . recessed, slam-action door catches . . . corrugated steel floor.

Available in 75", 90" and 104" lengths, equipped with accessories to fit your particular need.

Need more storage space? Any of the four Series 22 models can be furnished with an all-steel superstructure. In addition to any optional items desired, the superstructure is fitted with two full-length shelves and three swivel hooks on each side, a window in the head panel and grab handles at the rear.

Self-Elevating Ladder Assembly

This time-saving assembly with six rubber-covered rollers and four powerful coil springs enables one man to quickly and effortlessly erect a ladder up to 36′ in length. The operator lightly pushes the end of the ladder down, and the springs do the lifting. Stowing is equally fast and easy. Ideal for use on 75", 90" and 104" bodies. Includes 28′, 30′, 32′, 34′ or 36′ two-section extension ladder.

FOR ELECTRIC WORK

Series 22-E. Designed for service work in any phase of the electric utility industry. Special shelves and bins carry all the equipment and materials needed in the field.

FOR TELEPHONE WORK

Series 22-T. Compartmentized to carry a variety of telephone service tools, parts and materials. Standard arrangement of shelves and bins enables crewmen to quickly find items needed on the job.

FOR GAS WORK

Series 22-G. Two variations of this model are available for carrying either cast or tin meters. Rubber-padded compartments insure the safe storage of fragile parts and instruments.

Plenty of additional bins, shelves and racks carry tools, pipe, fittings, parts and all other equipment needed on routine or emergency service and maintenance calls.

Another reason why
UTILITIES EXPECT MORE FROM

POWERS American

UTILITY BODIES AND EQUIPMENT

McCABE-POWERS BODY COMPANY

5900 No. Broadway	625 Cedar Street	1461 E. Washington Blvd.	5525 S.E. 28th Ave.
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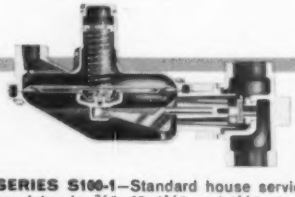
FISHER S-100 service regulators

(1) Relief Valve Post assures relief under all emergency conditions. (Patent Pending) (2) Weather and Bug Proof Vent is large size for relief purposes. Stainless steel stabilizer. (3) Full Capacity Internal Relief Valve meets ASA requirements B31.1.8 Code. (4) Turbo-Booster Tube assures unusually fine regulation and flow characteristics. (5) Flange Type Union permits 360° rotation of diaphragm assembly. (6) Hi-Tensile Iron Body ¾" to 1½" sizes.

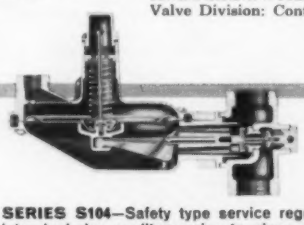
Also available with safety cut-off valve.

Saves on installation costs because of union joint construction. Service costs reduced because flange type union permits easy disassembly, quick changes of valve disc and orifices. Saves on shipping charges, aluminum alloy housing cuts weight. Meets all house service requirements.

Write for Bulletin P-S100 Fisher Governor Co., Marshalltown, Iowa. Plants in Woodstock, Ont., Rochester, England. Butterfly Valve Division: Continental Equipment Co., Coraopolis, Pa.



SERIES S100-1—Standard house service regulator in ¾", 1", 1¼" and 1½" sizes. Inlet pressures up to 100 psi. Various outlet pressure ranges and vent arrangements available.



SERIES S104—Safety type service regulator includes auxiliary valve to close-off flow completely in event inlet pressure falls too low, or flow rate becomes excessive. Manual reset to resume service.

SERIES S106-4—Incorporates safety shut-off and full capacity relief to prevent downstream pressure from rising above safe levels. Auxiliary valve closes completely if inlet pressure falls too low. Manually reset to resume service.

If it flows through pipe anywhere in the world ...chances are it's controlled by.....

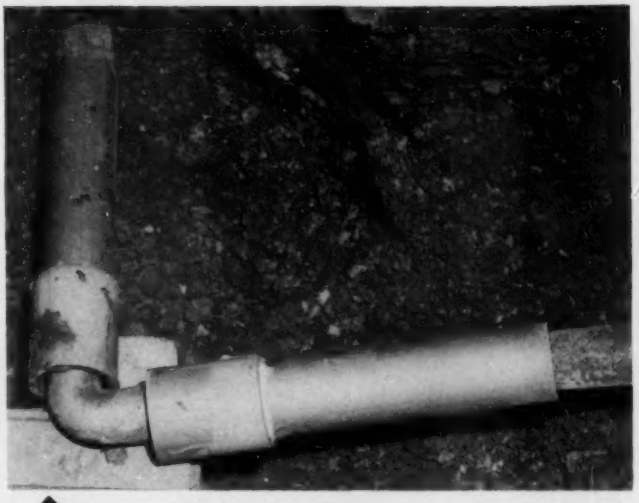
FISHER® Controls SINCE 1880

safe, sure renewal service with money-saving perfex materials

These photos show plastic pipe and other materials in actual installations of a major gas distribution company. All are products of Perfex Plastics, specialists with long experience in the renewal service field. Each product is held to specifications, precision-engineered with close tolerances—your guarantee of safe, sure service. For example:

PIPE and COUPLINGS

Here a new section of 1.375 in. plastic pipe is being inserted into old 1.50 in. steel service. This renewal service is available for 1"—1¼"—1½" and 2" I.P.S. gas service. Inside couplings plus thinner and cement are also available for joining all types of pipe.



PROTECTOR SLEEVE

Designed for maximum protection at the main where plastic pipe is inserted into old metal service. Scientifically engineered to assure safe, sure, long-lasting renewal life.

HEAD ADAPTER

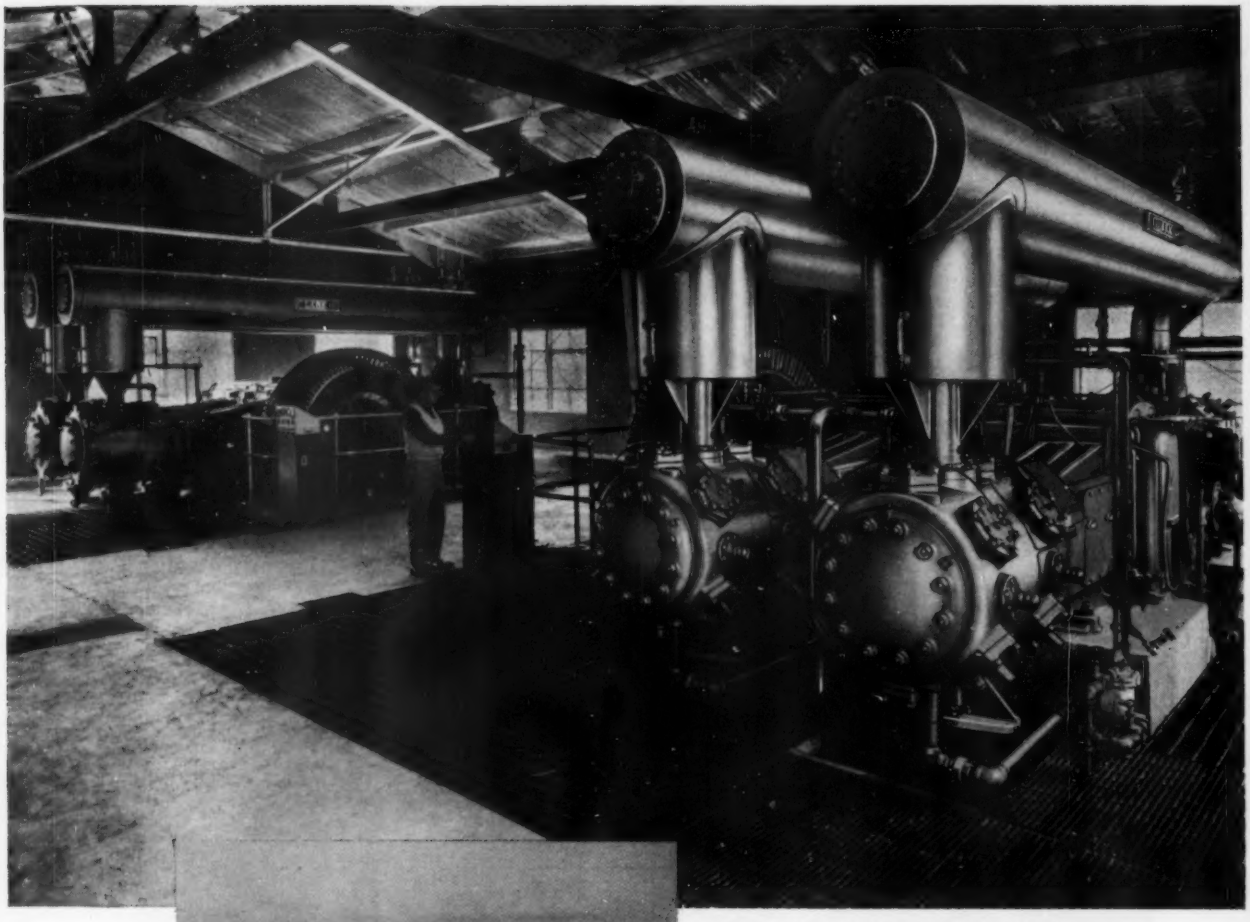
The strong link between metal and plastic service, patented by Perfex Plastics for economical, gas-tight headache-proof tie-in of the old and the new service. All parts of this head adapter are non-corrosive.

FOR DEPENDABLE, EXPERIENCED ONE-STOP SERVICE, LOOK TO

Supplier to America's Leading Gas Distribution Companies

perfex plastics inc.
2632 S. DEARBORN ST., CHICAGO 16, ILL.

for PEAK



Clark Model CLRA-4 Balanced/Opposed Compressors are of overhung rotor design. Heavy shaft and crankcase design eliminates the need for troublesome outboard bearings.

The Dicks Creek Gas Plant of Cincinnati Gas & Electric Company, near Cincinnati, Ohio.

SHAVING...

World's Largest High Pressure Gas Plant Goes Into Operation for Cincinnati Gas & Electric

Utilizing man made shale caverns 350 feet below ground level for liquid propane storage, Cincinnati Gas & Electric Co. have assured their customers of an adequate supply of gas during seasonal peak demand periods. Located at Middletown, Ohio, the plant's liquid storage caverns are supplied by a products pipeline which originates in the state of Texas.

The propane, vaporized by steam, is processed and blended with natural gas to achieve a Btu value approximating that of the original natural gas. Daily capacity of the plant is 50 million cubic feet.

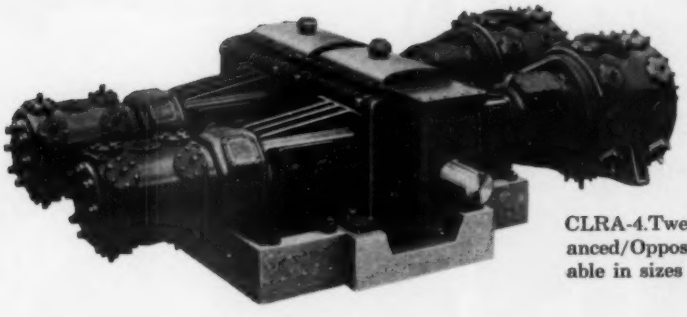
890,000 cfh of air is supplied to the gas plant by two Clark 1750 bhp Balanced/Opposed Motor Driven Compressors at pressures ranging from 150-225 psig.

Whether your gas storage problems involve liquid or gaseous product, Clark has a wide range of compressors and experience to fill your requirements. Write for bulletin 160.

CLARK BROS. CO.
OLEAN, N.Y.
Offices in Principal Cities Throughout the World

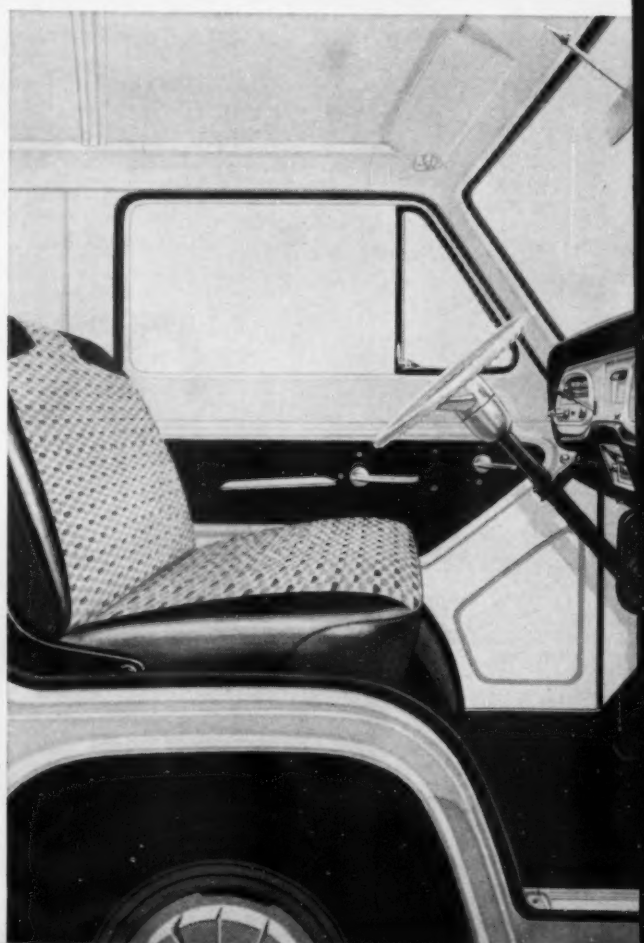
CLARK

Engines
Compressors
Gas Turbines

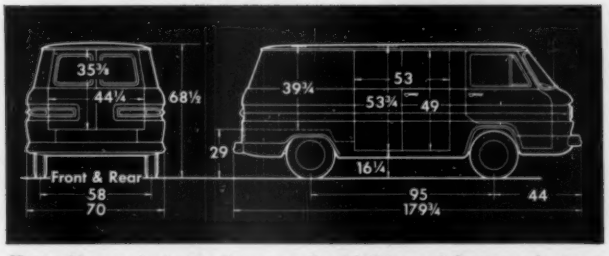


CLRA-4. Twenty-one models of Clark Balanced/Opposed Compressors are available in sizes ranging from 75-8000 bhp.

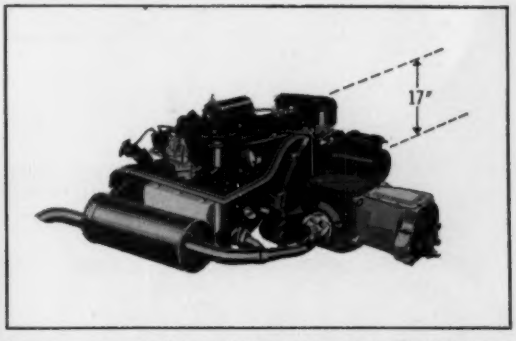
5938 CP



TOTALLY NEW ★★★★★★ CHEVROLET CORVAN MADE TO MEASURE FOR MORE EFFICIENT DELIVERY DUTY!



Measurably more load space than conventional half-tonners! Cargo area is almost 10 feet long, thanks to rear-engine design which eliminates the hood.



Corvan's rear-mounted "pancake" 6 measures only 17" high, top to bottom; it allows maximum load space in truck interior and lower loading height; and it packs plenty of power to boot!

■ Size up a new Chevy Corvair 95 Corvan and you'll see scores of features and dimensions that measure up to a new standard of profit-producing performance. Look at the whopping-big load space, for instance, made possible by the efficient rear-engine no-hood design. Or check the nearly *even* weight distribution, front and rear, that enables a Corvan to carry up to 1,700 lbs. of payload with a 4,600-lb. GVW.

Note, too, the short 95-inch wheelbase that pays off in nimble maneuvering and easy parking. And, while you're at it, try Chevrolet's newest engine, Corvan's rear-mounted aluminum Turbo-Air 6. Feel its fleet power and don't forget that it never needs anti-freeze or radiator repairs! (Tucked between the rear wheels, it stays out of the way and stays on top of fuel costs, too.)

But above all, don't miss the *quality* that's been engineered into this new panel. It shows up everywhere, but particularly in the chassis and body construction. In the tough integral floor-frame assembly, in the smooth independent 4-wheel suspension, and in built-to-last features like the two-position metal door checks and sturdy double-walled doors.

For eye-opening evidence of Corvan's unmatched utility, take a tape with you when you visit your Chevrolet dealer's and measure these advantages for yourself:

SPACIOUS DRIVER COMPARTMENT. Wide, unobstructed floor, plenty of leg room and head room. Full-width seat, 59¼" wide, is optional at extra cost.

BIG SIDE DOUBLE DOORS. They open so wide that you can load a 4' x 4' crate with ease! (Right-side doors standard; left-side doors optional at extra cost.)

EASY-LOADING REAR DOORS. These double doors are big enough (and open wide enough!) to make rear-end loading a breeze!

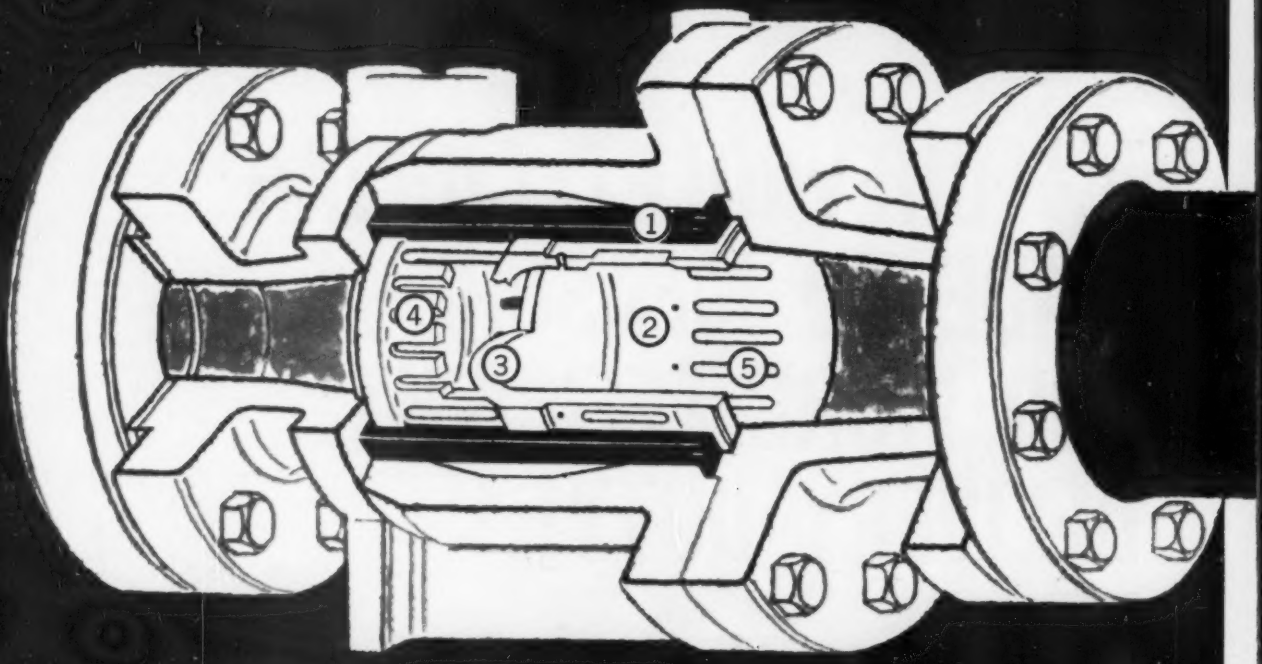
LOW LOADING HEIGHT. Only 16¼" at the side, only 29" at the rear (unloaded). Saves you work!

HIGH INTERIOR. Interior height is a full 4½ feet; that means more convenient cargo handling.

Your Chevrolet dealer can brief you fully on this new answer to more profitable deliveries, so see him soon. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

1961 CHEVROLET STURDI-BILT TRUCKS

CHEVROLET



SILENT

GROVE FLEXFLO® REGULATORS' ONE MOVING PART ASSURES TROUBLE-FREE CONTROL

A flexible rubber tube (1) is the only moving part in the Grove Flexflo. Silent flexing and rolling action of the tube over a core (2) can never slam, stick or wedge. Core barrier (3) forces incoming fluids up through the inlet slots (4) under the tube and down through the outlet slots (5) The flexible tube assures positive shut-off even though foreign matter may be trapped between the core and the tube. Design simplicity assures long, maintenance-free life. Flexflo can be self operated, pilot operated or used with electrical, pneumatic or hydraulic Grove operators. Proven in pressure reducing, back pressure, remote, automatic shut-off and manual open-shut services. Cast iron or steel bodies, sizes from 1" to 12", working pressures for gas, water and most petroleum products to 1,500 pounds. Write for Technical Presentation No. 850.

GROVE REGULATORS

GROVE VALVE AND REGULATOR COMPANY

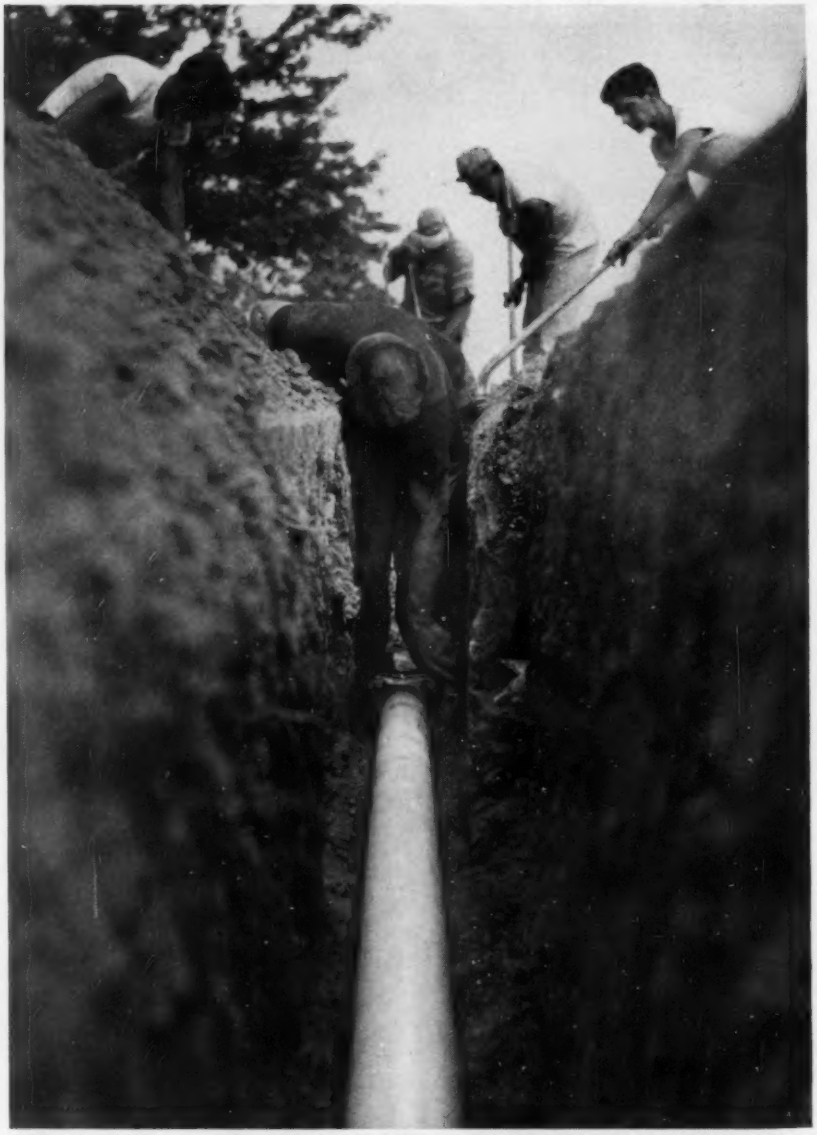
a subsidiary of Walworth • 6529 Hollis Street, Oakland 8, California

Offices throughout the United States and in Western Canada

You need no elaborate testing equipment, either. A pail of soapy water is all you need to check out the completed joint. Once it's soap-tested, it's checked... it's as simple as that. And, of course, the only tool you ever need is a wrench. Sizes 2 to 12 inches. Style 423 long sleeves available.

ALL SAVE TIME

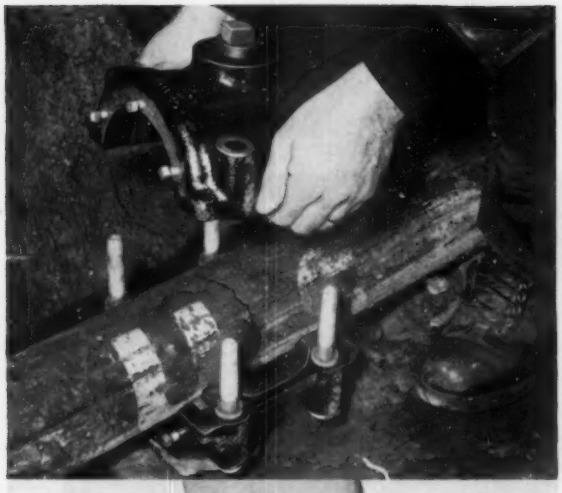
DRESSER® STYLE 123 COUPLINGS Save... save... save with the Dresser Stab-Clad® Style 123. The factory-assembled pre-coated coupling that makes it a black day for corrosion. Complete assembly gets 1, 2, 3 coating protection **at the factory**— Red-"D"-Shopcoat primer, coal tar epoxy resin, and coal tar enamel. Integral bond wire guarantees electrical continuity. 123's give corrosion its toughest fight. They're fast, too. Pipe ends just stab in. And tightening the bolts completes the job. No time wasted on priming and coating hard to get at places. You install the Stab-Clad coupling right out of the factory carton. Touch up (only if you want to) and protection is complete.

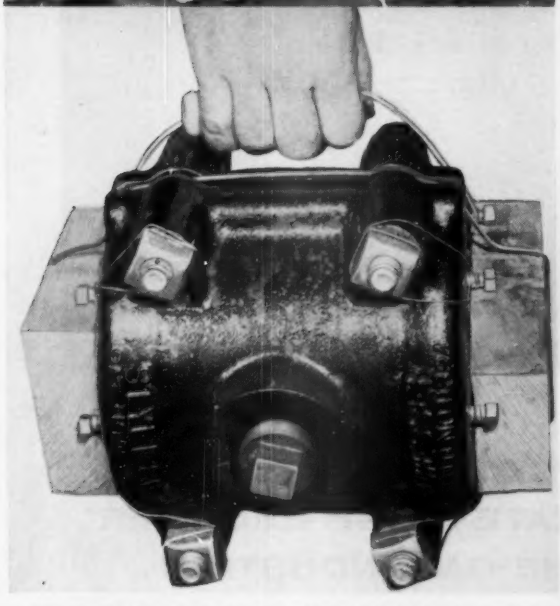


ALL SAVE MONEY

Save... save... save with Dresser® couplings and pipe repair products because they're developed specifically for the gas industry... with problems of costs, speed, and simplicity given prime consideration.

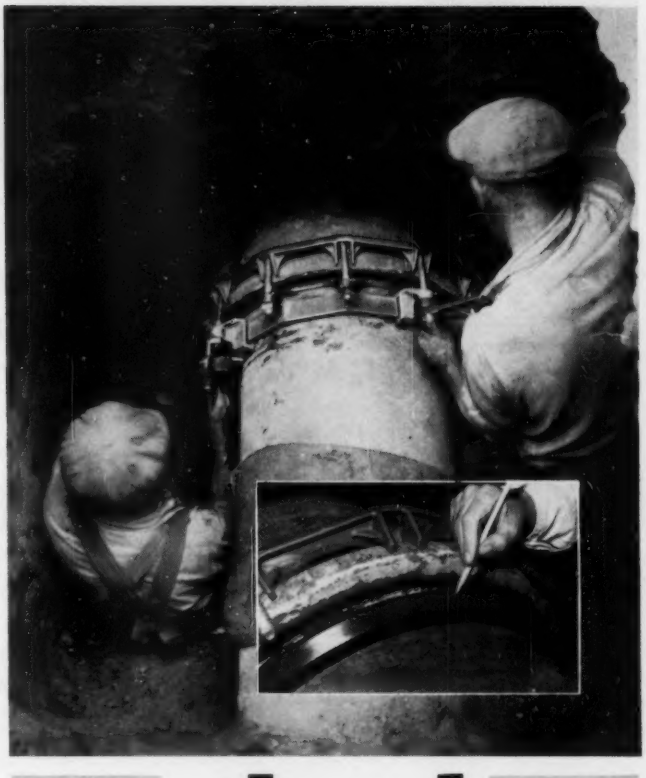
Ask your Dresser man for information on any component or all of the complete Dresser line. The Gas industry is his only business. You'll find him well qualified, and eager to help you in any way he can. DRESSER MANUFACTURING DIVISION, 61 Fisher Avenue, Bradford, Pennsylvania.





ALL SAVE WORK

DRESSER STYLE 60 BELL JOINT CLAMPS Save... save... save with Dresser Style 60's. Boosting main pressure often means clamping thousands of old bell and spigot joints made up to as long as a century ago. Dresser Style 60 clamps prove the most effective way to make leakproof joints for decades more. Dresser gaskets are of the proper durometer, hard enough to seal and soft enough to pack—and are wide enough to cover every pipe size you're liable to encounter—even the oddest. In a typical operation a good crew can install 12 Dresser Style 60's in a day... and those joints are gas-tight **permanently.** Sizes 3 to 60 inches.



DRESSER STYLE 80 READY-PACK SLEEVES Save... save... save with Dresser Ready-Pack Repair Sleeves. Repair cracked CIP mains in under 10 minutes at any hour, day or night. No loose parts, no gaskets to trim or fit. And they double as tapping sleeves, too! Take a Ready-Pack Sleeve, one man, a few minutes of action, and you've got a permanent, gas-tight seal... even on offset pipe. And you even get the wrench packed with the unit. These versatile repair sleeves pay for themselves many times over in shortened traffic tie-ups, short service interruptions, and less service crew time. Style 80 sizes 2 to 8 inches.

ANOTHER DRESSER THREE-WAY SAVER

Dresser "UTIL-SEAL." A complete epoxy resin repair kit with unlimited uses on pipe joints and fittings plus tanks, valves, and tubing. Inexpensive, fast, easy to use. Carry one on every truck for emergencies, or, where a clamp can't be used.

dmd

DRESSER

MANUFACTURING DIVISION

BRADFORD, PENNSYLVANIA

DRESSER INDUSTRIES, INC.,

OIL • GAS

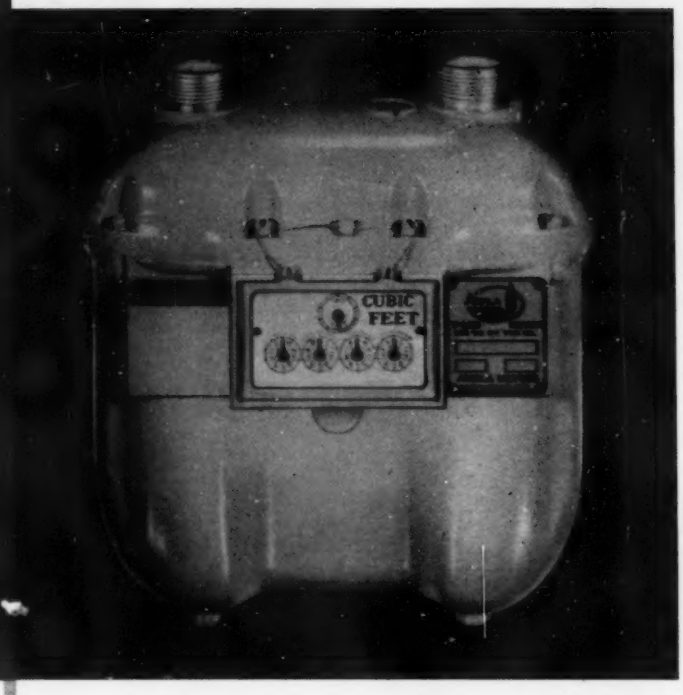
CHEMICAL

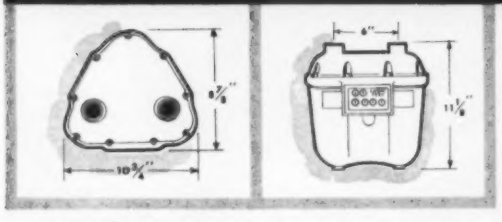
ELECTRONIC

INDUSTRIAL

SERVING THE GAS INDUSTRY HAS ALWAYS BEEN OUR BUSINESS

V 250 GAS METER





Dimensions: The Arkla V250 Gas Meter weighs less and is smaller than any other 250 cu. ft./hr. gas meter.

A NEW, COMPACT, ACCURATE "CASH REGISTER" FOR THE GAS INDUSTRY!

EXCELLENT ENGINEERING AND DESIGN of this gas meter, first of a new, modern line, are evident in its light weight and compactness that make the Arkla V250 Gas Meter easy to install . . . fewer moving parts reduce maintenance . . . accuracy of the Arkla V250 Gas Meter makes it a welcome "cash register" for the gas industry.

Order ARKLA V250 GAS METERS TODAY. *(Other models available soon.) For further information, write or call us, or ask your Arkla-Reynolds Gas Regulator representative.*

ARKLA

WRITE OR CALL:

A Division of Arkla Air Conditioning Corporation

this means excellence

so does this

U.S. PIPE
CAST IRON

Cast iron pipe bears no ribbons signifying excellence. But it could. Its record earns one . . . throughout the nation the cast iron gas mains of 55 major utilities are still serving after a century and more of service. U. S. Pipe dependability is achieved through rigid manufacturing control and inspection. Every step of the way . . . from mine to finished product . . . U. S. Pipe is subjected to exacting quality tests. This added care is translated into added service and long, trouble-free life . . . in your trench. The name U. S. Pipe stands for cast iron at its best.

• Standardized mechanical joints are bottle-tight for usual gas distribution pressures . . . and for all types of gas • Centrifugally cast pipe is tough, uniform, strong • Joint design allows for deflection during and after installation • Service connections are easily made • Long life is a matter of record

U. S. PIPE & FOUNDRY COMPANY
General Office, Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE

WHY IS
AUBURN
THE
QUALITY TRENCHER?

Where it's manufactured?

Auburn Machine Works, Inc., established 1928, long known as the "House of Trenchers" is justly proud of its modern, precision equipped manufacturing facilities. Equipment that assures "Quality Controlled" production.

How it's manufactured?

AUBURN'S skilled craftsmen have a pride of workmanship that comes with years of experience, training, and study in the manufacturing of trenching equipment. Their expertness in the operation of precision machine tools and their thorough mastery of the measuring and testing devices used throughout each stage of production, is your guarantee of the quality of the AUBURN.

Job proven... Simple in design the Auburn Trencher is a perfect example of quality and ruggedness. It digs up to 800 ft. per hour—trenches 6" to 14" wide and down to 6 ft. deep.

Auburn owners, all over the world, have proven that quality means dependable performance and the most economical operation on all types of jobs.

AUBURN MACHINE WORKS, INC.
2055 South J Street, Auburn, Nebraska, U. S. A.
Phone BRidge 4-3141

Please send complete information and name of nearest dealer.

*Name*_____

*Address*_____

*City*_____ *State*_____

Current Reading

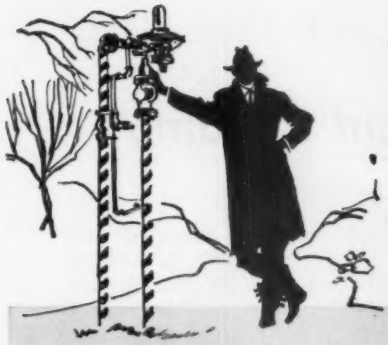
SAFETY AT GAS-PROCESSING PLANTS—The first new Bureau of Mines publication on this subject since 1929, this book was compiled by the Bureau's G. M. Kintz and Francis C. Hill. It is based on work done by both the bureau and the Natural Gasoline Association of America. A special NGAA subcommittee—under the chairmanship of A. W. Breeland of Lone Star Gas Co.—rewrote sections of the 1929 work, "Safety at Natural Gasoline Plants." The 98 pages are almost equally divided between design and operating subjects. All phases of both subjects are covered. Profusely illustrated, the book has 54 photos and drawings, plus five tables. This soft-bound, 7¾ x10⅛-in. book may be obtained for 50 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

GAS VENT TABLES—AGA Labs have published gas vent tables for designing single and multiple appliance gas vent systems. Individual tables cover double wall metal vent pipe, single wall or asbestos cement vent pipe, and masonry chimneys for a single appliance vent application. Corresponding tables for multiple appliance vent applications also are included. Copies of Research Report 1319 are available from the AGA Laboratories, 1032 E. 62nd St., Cleveland, or AGA headquarters, 420 Lexington Ave., New York 17. Price: $1 each.

A SURVEY OF SECONDARY RECOVERY AND PRESSURE MAINTENANCE OPERATIONS IN TEXAS TO 1958—This survey was prepared by the engineering department of the Texas Railroad Commission. Copies are available from the Interstate Oil Compact Commission, P. O. Box 3127, Oklahoma City 5, Okla. Price: $2.

TENTATIVE STANDARD CHROMATOGRAPHIC TEST PROCEDURE FOR THE DETERMINATION OF PROPANE, BUTANES, AND PENTANES PLUS IN NATURAL GAS—California Natural Gasoline Association's Technical Bulletin TS-611 covers a rapid and accurate test method, based on gas chromatography, for determination of propane, butanes, and heavier hydrocarbon in gases associated with petroleum. Included in the bulletin is a de-

(*Continued on page* 48)



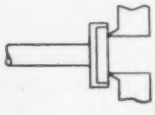
Your *FISHER/MAN* offers you a silent sentinel with hundreds of applications

FISHER TYPE 99

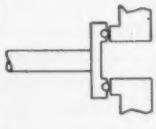
MULTI-PURPOSE PRESSURE REDUCING GAS REGULATOR

This one all-purpose regulator handles literally dozens of complex control jobs that now require several types of regulators in combination. The control installation is simplified. Initial costs are cut. Maintenance on the line is minimized. In a few minutes Type 99 converts to high or low pressure pilot with minimum parts required. If you want additional information about capacities and construction details write Fisher for Bulletin P 99C.

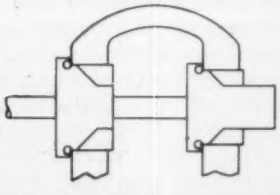
ORIFICE SIZES— INNER VALVE STYLES



⅛" Composition Disc Single Port. Max. Inlet 250 psi. 1⅛" Composition Disc Single Port. Max. Inlet 150 psi.

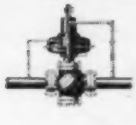


⅞" "O" Ring Single Port. Max. Differential 250 psi. 1⅛" "O" Ring Single Port. Max. Differential 250 psi. (with heavy main spring) 2" "O" Ring Single Port. Max. Differential 40 psi.



2" "O" Ring Double Port. Max. Differential 100 psi.

1. **The factory pre-set spring provides powerful lock-off action.**
2. **Large, effective area of main diaphragm in combination with relay pilot assures trouble-free accuracy.**
3. **It is only a matter of minutes and a minimum of parts to convert to high or low pressure pilot.**
4. **2" threaded or flanged inlet and outlet. Standard hi-tensile iron body for up to 150 PSI inlet, XH or bronze body for up to 250 PSI inlet.**
5. **Composition valve disc assures tight shutoff on zero flow and excellent regulation from low flow to maximum capacity.**



IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . .

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / London, England

CONTINENTAL EQUIPMENT CO. DIVISION, Coraopolis, Pennsylvania

FISHER Controls

SINCE 1880

What you get from

GLAMORGAN

with

GP-MARLEX®

Engineered

gas pipe

EXPERIENCE. Glamorgan Plastics is a division of Glamorgan Pipe & Foundry Company, a leader in pipe manufacture for over 75 years.

QUALITY. Glamorgan's modern new pipe extrusion plant, quality testing laboratories, and experienced personnel combine to bring you superior pipe extruded from Marlex* resin conforming to the highest standards for smooth surfaces, precise dimensional shape, concentricity, and impact strength.

SERVICE. Glamorgan's Technical Service Department smooths out all problems by bringing expert knowledge to your specific application of GP-Marlex* *Engineered* gas pipe.

ECONOMY. *Engineered* gas pipe produced from Marlex* resin costs less to handle, install, and maintain. It is easily cut with a common hand saw and fusion joined with a simple, inexpensive device. Installation costs will be cut drastically.

SATISFACTION. Pipe of Marlex* resin won't rust or rot; takes hard usage even in cold climates. Smooth inside walls boost flow rates substantially.

A complete service from Glamorgan. Send for technical and descriptive information.

gp

glamorgan plastics

A Division of Glamorgan Pipe & Foundry Co

LYNCHBURG, VIRGINIA

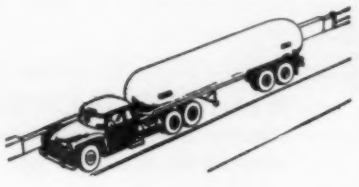
*A trademark for Phillips family of olefin polymers.

Current Reading

scription of the necessary equipment and tentative procedure for sampling and analysis. Available from California Natural Gasoline Association, 510 West 6th St., Los Angeles 14. Price to members: $4; to nonmembers: $6.

EXPERIMENTAL OVEN — Design and performance of the experimental "Celeriter" deck oven is covered in a new research bulletin from the AGA Laboratories. The experimental oven was designed to use forced convection as an improved means of heat transfer in a deck oven. In addition, the oven was equipped with a perimeter radiant burner system mounted in the baking compartment roof. The bulletin describes the design features of the Celeriter, the effect of air flow variations on baking, hearth baking as compared to rack baking, and effects of combustion products in the circulating air stream. Research Bulletin 85 is available from AGA Laboratories, 1032 E. 62nd St., Cleveland 3, Ohio, or AGA headquarters, 420 Lexington Ave., New York 17. Price: $2.

AWS BIBLIOGRAPHIES—The American Welding Society has announced publication of the 1960 Supplement to the AWS Bibliographies. The original publication contained bibliographies of articles which appeared in the *Welding Journal* from 1937 through 1957. Each year a Supplement is compiled listing the previous year's articles. The bibliographies previously issued listed articles under 28 subject headings. The current supplement contains listings of all articles appearing in the *Welding Journal* from January through December 1960. The complete bibliographies thus provide a record of all articles on welding, welding research, and related subjects which have appeared in the society's magazine from 1937 through 1960. Copies of the 1960 Supplement to the AWS Bibliographies may be obtained from the American Welding Society's Technical Department, 33 W. 39th St., New York 18. Price: $1.50.



Light, strong, non-corroding . . . plastic pipe made of High Density MARLEX*

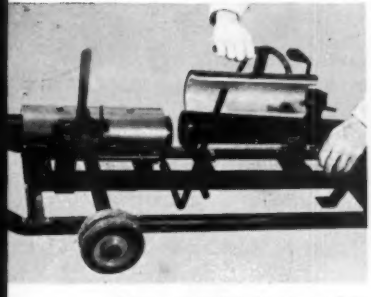
Low cost, more economical installation, and long service life are big reasons for the increased use of coilable and straight lengths of MARLEX pipe for gas distribution, crude oil lead lines, gas and crude gathering, salt water disposal, supply lines for gas pump engines, and the like. For example, 2-inch Schedule 40 MARLEX pipe costs less than equivalent steel pipe . . . will not corrode or scale up . . . and, since it weighs about ⅛ as much, is more economical to ship, handle, and install. Even the larger diameter MARLEX pipes can be handled without hoists, side-boom cats, or other heavy equipment.

No other type of pipe is as tough, durable and easy to use as pipe made of MARLEX TR-212 (ASTM Type 3 Polyethylene classification). It has good load bearing characteristics, a wide usable temperature range, and is virtually indestructible . . . resists acids, solvents, alkalies, bacteria, rot, and fungi.

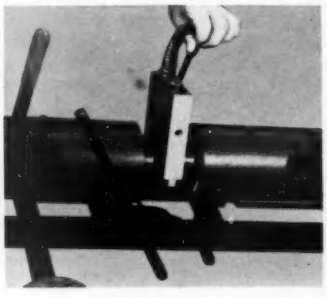
For samples and details on MARLEX pipe, see your pipe supplier . . . or contact us directly.

*MARLEX is a trademark for Phillips family of olefin polymers.

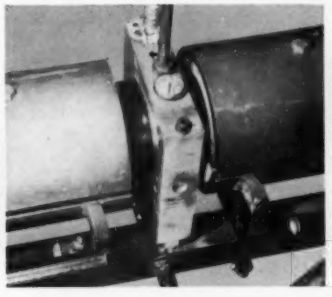
Low-Cost, Butt Fusion Makes Strong Joints Quickly and Simply!



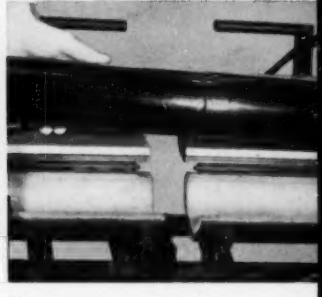
Pipe or conduit is clamped in portable fusion rig.



Thermostatically controlled heating plate is inserted.



Ends to be joined are heated in a matter of seconds.



No waiting . . . joint is even stronger than pipe.

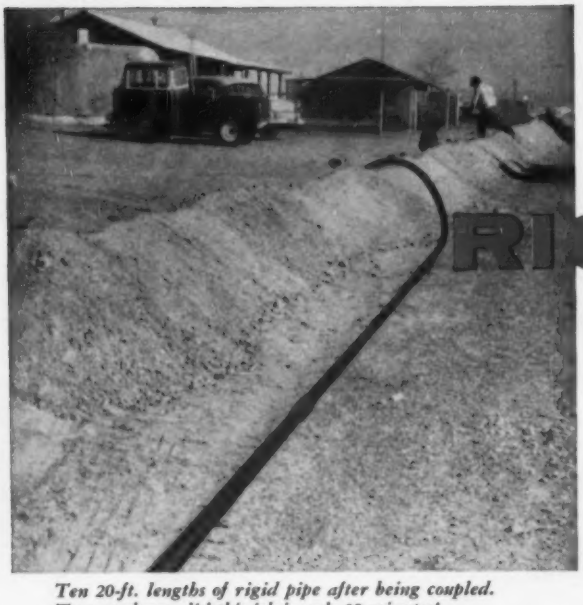
Look for the MARLEX label! It's your assurance of quality and durable performance.

PHILLIPS CHEMICAL COMPANY

Bartlesville, Oklahoma

A subsidiary of Phillips Petroleum Company

PHILLIPS 66 MARLEX



Ten 20-ft. lengths of rigid pipe after being coupled. Two workmen did this job in only 20 minutes!

Workmen joining two sections of 1¼" rigid pipe.

ARIZONA PUBLIC SERVICE COMPANY SAVES 50% WITH

RIGID PIPE

made of ABS Plastic

RIGID PIPE GAS SYSTEM INSTALLATION OFFERS NEW PROOF OF SUPERIORITY OVER CONVENTIONAL TYPE

Big news for happy housewives in Gila Bend, Arizona—the convenience of gas utility service for the first time! Important news for utility companies everywhere—the 50% savings over cost of conventional pipe gained by use of Anesite rigid ABS pipe made of CYCOLAC throughout the system! Saved precious man-hours, too! Arizona Public Service Company completed the job in record time . . . insured a failure-free system with this lightweight, leak-proof pipe. Another example of better service . . . bigger savings from rigid plastic pipe in vital municipal installations!

BE *ABSolutely* SURE . . .
INSIST ON RIGID ABS PIPE
made of
CYCOLAC®
THE BORG-WARNER PLASTIC THAT IS TOUGH, HARD AND CORROSION-RESISTANT

Write for the name of your nearest supplier

MARBON CHEMICAL
WASHINGTON

MARBON CHEMICAL B-W BORG-WARNER

DIVISION BORG-WARNER
WEST VIRGINIA

TLC* dryer control thinks for itself

. . . all she does is set the dryness she wants!

Robertshaw TLC* dryer control does for the laundry what automatic cooking has done for the kitchen!

Robertshaw's TLC* dryer control automatically determines evaporation taking place by measuring temperature drop of air passing through wet clothes . . . calculates with extreme accuracy the amount of drying required for any size load, any fabric, any mix. Temperature is gradually reduced as clothes approach desired dryness. When set dryness is reached, heat is turned off for gentle fan-cooling.

Results: *tender, loving care* for even the daintiest things, because:

- TLC eliminates drying time guessing . . . *there is no timer*
- TLC dries everything from single handkerchief to full load
- TLC drying temperatures safe for all fabrics . . . any mix
- TLC prevents over-drying . . . and reduces tumbling wear
- TLC delivers cool, dry clothes . . . wrinkling reduced
- TLC is as simple to operate as your range oven control

In short . . . TLC dries clothes safely . . . in the least amount of time . . . economically . . . automatically . . . *and without a timer* . . . not even a hidden one! Specify Robertshaw TLC control on your 1962 dryers.

VMA7798

Robertshaw

MR. CONTROLS

. . . the name that MEANS temperature control

ROBERTSHAW THERMOSTAT DIVISION
Robertshaw-Fulton Controls Company
Youngwood, Pennsylvania

Canadian Affiliate
Robertshaw-Fulton Controls Company, Limited, Toronto

*Trade Mark — Robertshaw TIMER-*less* control system for *any* dryer (available on 1962 dryers)

LIGHT WALL X-TRU-COAT

gives you the best protection at the lowest cost...

You get improved protection...reduced costs...with Republic's X-TRU-COAT. High density polyethylene plastic, continuously extruded over light wall pipe, stops corrosion...seals out electrolytic action. Republic Light Wall is available in 1.315" through 4.500" O.D. The X-TRU-COAT package includes X-TRU-TAPE and primer for joint protection.

Republic X-TRU-COAT—available in 1" through 8" nominal—is produced under the DEKORON® Process. Contact your Republic salesman or write Republic Steel Corporation, Dept. GS-1815-A, 1441 Republic Building, Cleveland 1, Ohio.

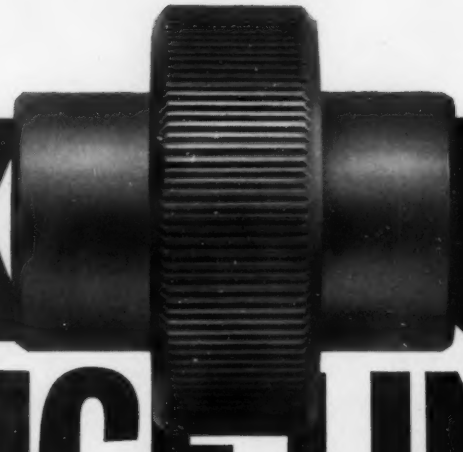
REPUBLIC STEEL
Cleveland 1, Ohio

Electric Weld • Seamless • Fusion Weld • X-TRU-COAT • Continuous Butt Weld • Light Wall • Plastic Pipe

Steel

Strong, Modern, Dependable

LINK UP SERVICE LINES WITH WALWORTH PVC

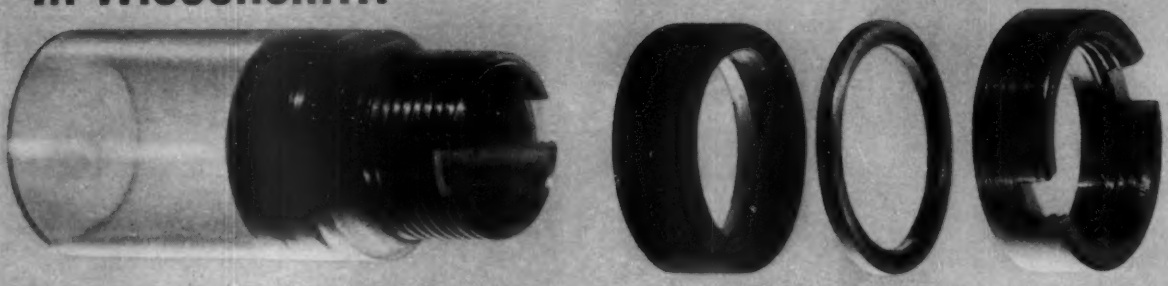


Corrosion-resistant leakproof unions. Rigid, unplasticized PVC in both high and normal impact types. Takes 1½ times maximum working pressure of like-rated PVC service pipe. Knurled rings turn up gas-tight by hand. Can even accommodate slight misalignments. Your choice of both threaded and solvent-weld socket-type ends. Variety of sizes. **Flanged fittings.** Available from 1" up in both high and normal impact types. One-piece integral units with rupture strength exceeding equivalent pipe. **Tees and Ells.** Walworth Distributors stock a complete line of threaded and solvent weld Tees and Ells as standard items. Ells available in both 90° and 45° types—variety of sizes. Contact your nearby Walworth Distributor today...and while you're at it, arrange for your private showing of Walworth's new 12-minute sound-slide film entitled "PVC FACTS."

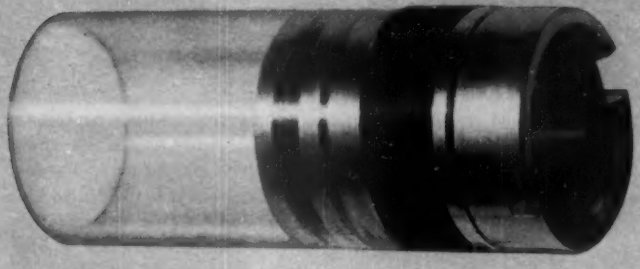
Walworth Company, 750 Third Avenue, New York 17, New York

WALWORTH SUBSIDIARIES: Alloy Steel Products Co. ■ Conoflow Corporation ■ Grove Valve & Regulator Co. ■ M&H Valve & Fittings Co. ■ Southwest Fabricating & Welding Co., Inc.

In Wisconsin...



Perfex adapters simplify Butyrate service renewals



Wisconsin Public Service Corporation makes quick, economical plastic-to-metal service head connections with a new leakproof adapter

Wisconsin Public Service Corporation is one of the latest major utilities to adopt plastic tubing of Tenite Butyrate for service renewals. A time-and-money-saving highlight of their installation procedure is the use of a patented service head adapter developed by Perfex Plastics, Inc., of Chicago. With this new adapter, service head fittings are made neatly in existing lines with no repiping or offsetting (see illustration).

Using Butyrate tubing, the utility estimates that a crew of two men can install 2½ to 3 renewals per day. An exclusive feature of Butyrate gas tubing is its availability in transparent form—a feature especially useful when plastic-to-plastic joints are made, since the red cement employed permits the crew to make a visual check of the solvent weld.

Tubing of Tenite Butyrate is available in 20-foot lengths or in continuous coils. Since 1943, well over 1,000 miles of this tubing have been installed by three major utilities alone, for both renewals *and new services.*

When your company starts thinking about a plastic pipe material, think first of Tenite Butyrate, the favorite among natural gas distributors. For further information, write to EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENN.

How service head adapter works:

The service head adapter consists of a 3-in. length of transparent tubing sealed to a threaded metal sleeve. Plastic end of adapter is solvent-welded to the Butyrate pipe that has been inserted into the corroded metal service line. Special spanner wrench has lugs that fit into collar on adapter, and is used to force collar against a natural rubber gasket that expands to fit tightly against inside diameter of the old service pipe, making the renewal gastight and leakproof.

The complete renewal kit, as sold by Perfex, also includes an inner compression sleeve and an outer protective sleeve for the main end connection, plus tubing and solvent cement.

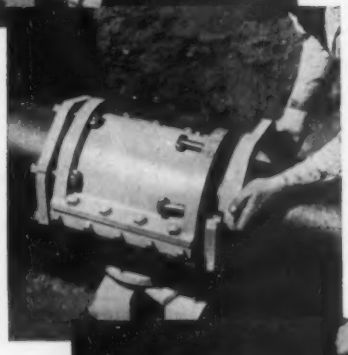
TENITE®
BUTYRATE
an Eastman plastic

THE ANSWER TO CONNECTION PROBLEMS

BRANCH CONNECTIONS

MADE UNDER PRESSURE

1



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3

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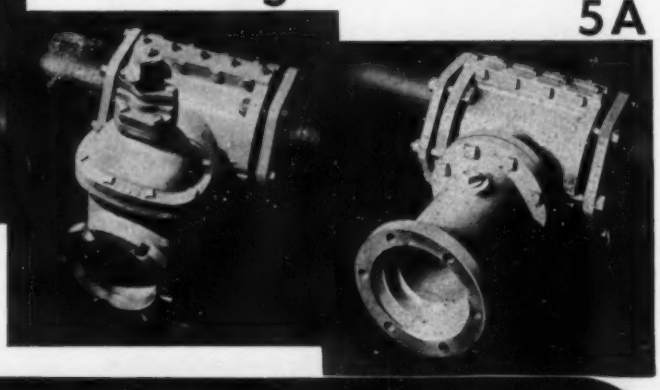
5A



The best and most economical method of making lateral or branch connections is to use Smith All Mechanical Joint Tapping Sleeves and Valves or Stopper Pieces. This method ELIMINATES GAS SHUT OFF and the permanent, leak-proof installation is achieved speedily by employing these simple procedures: 1. Block Sleeve Outlet Half under pipe, position side flange gaskets, bolt Sleeve halves together. 2. Position end joint gaskets; install follower rings, bolts and nuts. 3. Rotate Sleeve outlet flange to desired position, tighten follower ring nuts. 4. Tighten side flange gasket compression screws. 5. Attach Tapping Valve. The installation is complete and ready for tapping. 5. (Alternate) Stopper Pieces may be used in place of Valves when connections are made to low pressure mains and permanent shut off Valves are not needed; however, the use of Tapping Valves is recommended. The cost of the connection is reduced by quicker installation, elimination of skilled labor and costly jointing material. Bulletin will be sent on request.

51

FIRE HYDRANTS · VALVES · SINCE 1896

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

PIPE LINE SERVICE CORPORATION
now offers
X-TRU-COAT

PIPE LINE SERVICE CORPORATION
X-TRU-COAT
PAT. NOS. 2,447,420 - 2,457,642

Contributing once again to the progress of the Gas and Oil Industry, Pipe Line Service Corporation, pioneer in the field of steel pipe protection, offers you the application of X-TRU-COAT.

X-TRU-COAT is a High Density Polyethylene extruded on steel pipe over a pressure sensitive adhesive, produced under the Dekoron process.

Pipe Line Service is the first Independent Coating Company to apply X-TRU-COAT, and is now offering *Immediate, Unlimited Production* at our Sparrows Point, Maryland plant on pipe sizes ½" through 4½" O.D. pipe. X-TRU-COAT will soon be available at our new Youngstown, Ohio plant (presently under construction) in early Spring, 1961.

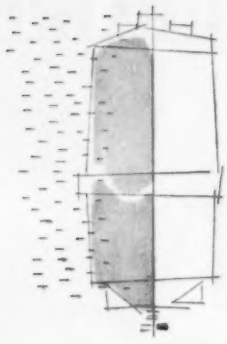
For prices and complete information about this new service, call or write Pipe Line Service Corporation, P.O. Box 318, Franklin Park, Illinois.

Pipe Line Service Corporation

A SUBSIDIARY OF AMERICAN STEEL FOUNDRIES

General Offices and Plant: Franklin Park, Ill.

Quality pioneers in coating and wrapping pipe for over a quarter century



DOLLINGER
DRY FILTER
SPECIALISTS
FOR 40 YEARS

REMOVE DRY OXIDE, STICKY OIL DEPOSITS FROM GAS LINES

Dollinger Staynew Gas Filters are the ideal answer for eliminating damaged valves and clogged pilots on natural gas lines, and for stopping lamp black and moisture in manufactured gas lines. Staynew Gas Filters have gained a wide reputation for economical, efficient filtration at many of the largest industrial and utility plants in the country.

At district regulator stations and large meter and control centers, Dollinger Staynew Gas Filters are unequalled for pipe line filtration. The filters employ a unique double action principle that cleans gas by two processes. Mechanical separation directs the flow of gas into the base at high velocity, where water, oil and heavier particles of rust, scale and dirt are deposited. Then the gas, having been mechanically cleaned, is filtered through the Radial Fin insert at low velocity, removing any remaining particles. The Radial Fin construction is unequalled as an efficient form of pipe line filtration. It offers the largest possible active filtering area for the space it occupies—this means high efficiency at low resistance without constant servicing.

Dollinger Staynew Gas Filters are available in single units with capacities to 300,000 SCFH, and in multiple units for larger capacities. The filters shown above handle 6,600,000 SCFH.

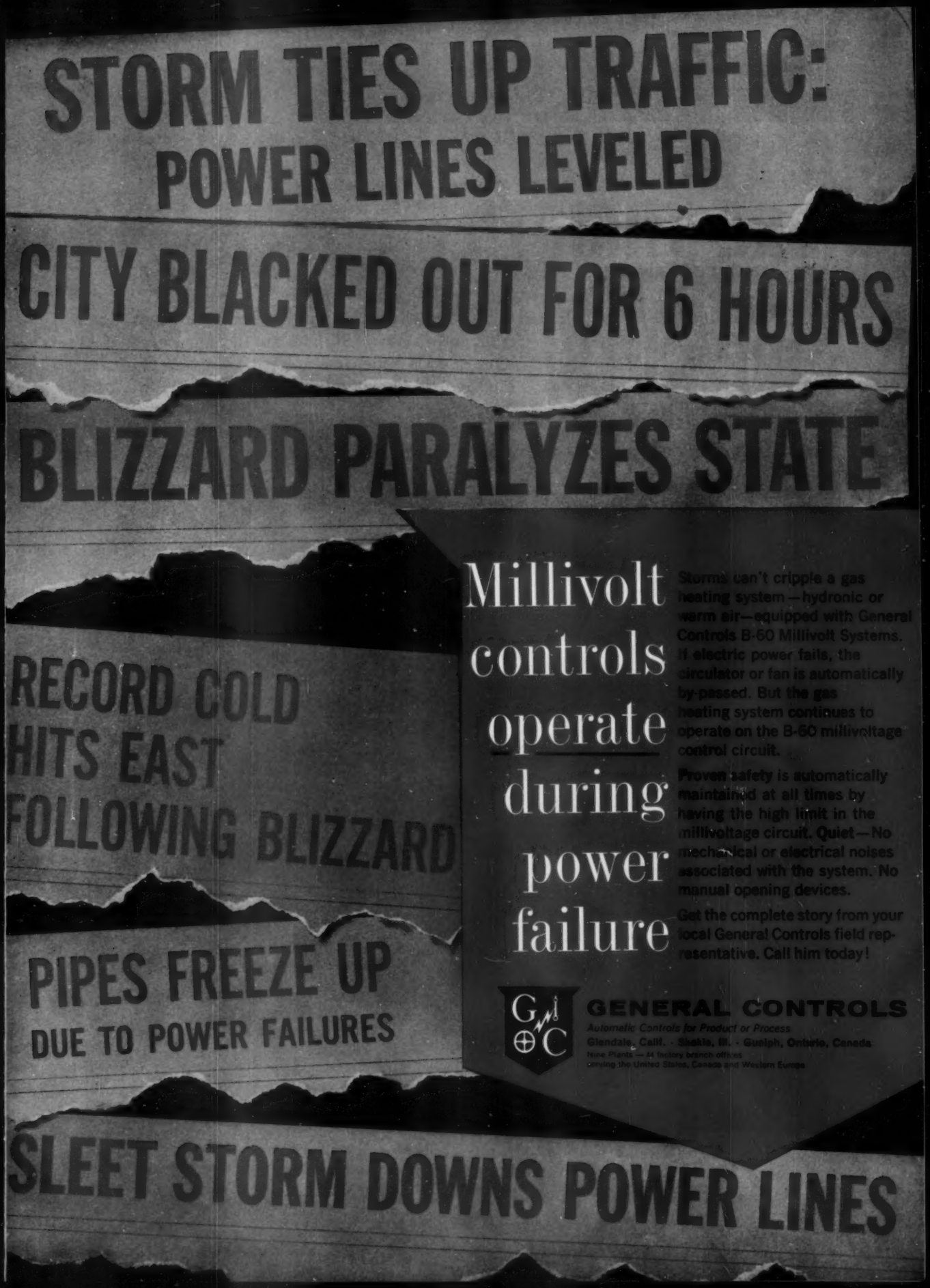
For inspection and cleaning, interior parts of Staynew Gas Filters are easily accessible—the "insides" are quickly exposed *without* breaking pipe connections. Inlet and outlet connections of Staynew Gas Filters may be varied to suit each individual installation.

Consult your Dollinger representative for assistance with your gas filtration problems. Call him, or write for Bulletin 290-R, Dollinger Corporation, Industrial Products Division, 68 Centre Park, Rochester 3, New York.

PROTECTOMATIC

STAYNEW DOLLINGER FILTERS

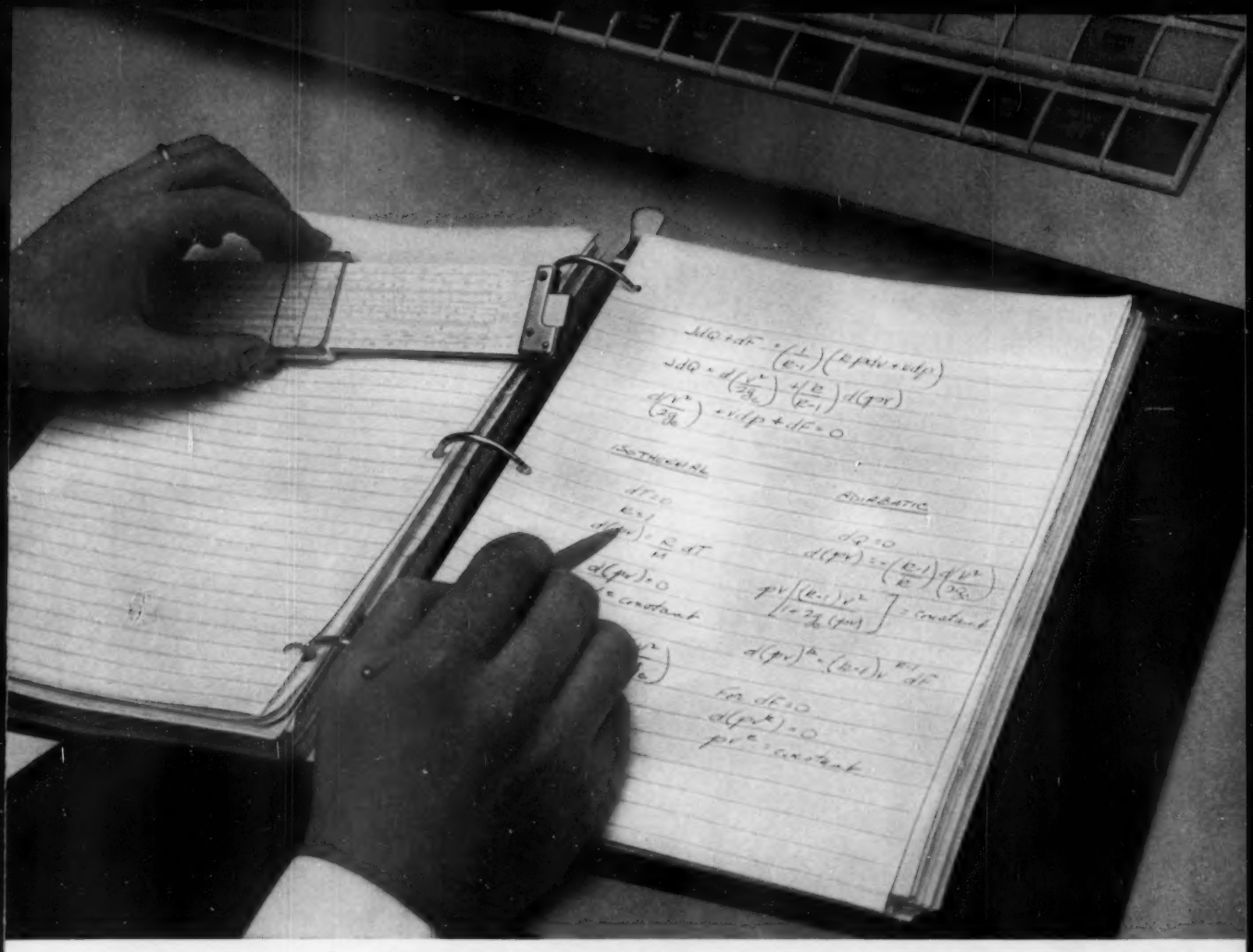
LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS


STORM TIES UP TRAFFIC:
POWER LINES LEVELED
CITY BLACKED OUT FOR 6 HOURS
BLIZZARD PARALYZES STATE
RECORD COLD
HITS EAST
FOLLOWING BLIZZARD
PIPES FREEZE UP
DUE TO POWER FAILURES
SLEET STORM DOWNS POWER LINES
Millivolt controls operate during power failure
Storms can't cripple a gas heating system—hydronic or warm air—equipped with General Controls B-60 Millivolt Systems. If electric power fails, the circulator or fan is automatically by-passed. But the gas heating system continues to operate on the B-60 millivoltage control circuit.
Proven safety is automatically maintained at all times by having the high limit in the millivoltage circuit. Quiet—No mechanical or electrical noises associated with the system. No manual opening devices.
Get the complete story from your local General Controls field representative. Call him today!
GENERAL CONTROLS
Automatic Controls for Product or Process
Glendale, Calif. · Skokie, Ill. · Guelph, Ontario, Canada
Nine Plants — 44 factory branch offices
serving the United States, Canada and Western Europe

MORE HAUL!
NO STALL!
MORE THRIFT!
NO SHIFT!
MORE GUTS!
NO BUTS! (...IFS OR ANDS!)

First on the job, last off – Moline's MoTrac puts out more work per dollar invested than any other crawler. Here are some reasons. The MoTrac's Torque Converter drive with toe-operated Hydro-Shuttle lets you change speed or direction *instantly*. From full ahead crowding to full reverse without shifting. And your hands are free at all times to steer and load. Result? Faster cycles, more yardage per hour. No stalling under heaviest loads either; no wasted time. Reason? The famous Moline engine, built for high torque at low rpm. Plus the heavy cast and solidly bolted power train—an unshakeable column of strength from end to end. And here are more features: 1000 hour service rollers, simplified controls, 1¼ yard bucket. For maneuverability, versatility, and solid build you can't beat the MoTrac at *any* price. You'll tackle anything and everything with your MoTrac. Test drive it at your Moline dealers today.

MoTrac® BY MINNEAPOLIS MOLINE



Solve network analysis problems in minutes with the new low-cost IBM 1620

The new IBM 1620 Data Processing System carries out gas network analysis for as many as 750 pipes in low and medium pressure systems. It also evaluates much larger networks by carrying pipe data in a supplementary paper tape unit as calculations progress. You'll find the 1620 an economical investment for other reasons, too...

EASY TO USE—It takes only a two-day training class and you begin programming your own problems.

In addition, you get a wide range of free programming services including FORTRAN and GOTRAN. FORTRAN is the powerful scientific language that lets you solve problems without writing detailed computer instructions. GOTRAN is a simplified language (a sub-set of FORTRAN) that lets you enter simplified problem statements and data into the computer with the solution immediately available, in one simple operation.

FAST—The 1620 computer is so fast you can solve a set of ten simultaneous equations in only 20 seconds.

POWERFUL—The 1620 saves you time with many other complex problems—pipeline design and simulation—compressor performance studies—gas measurement—load trends—burner efficiency of gas—reservoir phase behavior.

GET FULL DETAILS—Find out how a small monthly investment can free you for more creative work. A basic 1620 solid state computer rents for just $1,600 a month. Call your IBM representative.

IBM's 1620 is a compact desk-size computer.

IBM®
DATA PROCESSING

Remember the joints!

Finish your pipe protection with Johns-Manville DURATAPE

If you use hot-wrap methods on your pipe lines, give joints and fittings the protection they need with J-M DURATAPE. It forms a tough dielectric barrier with outstanding resistance to soil stresses and impact damage, as well as to corrosive soil conditions. DURATAPE is made of high-tensile glass fibers, heavily coated with coal tar or asphalt. It's tough yet pliable and easy to install. Under a low-temperature torch, it will conform to fittings, such as elbows and tees. And for wrapping with cold compounds, specify J-M Duramesh . . . a porous fiber glass mesh fabric that reinforces standard protective coatings, helps prevent cracking and holidays. Ask your J-M Representative for full details, or write Johns-Manville, Box 158, Dept. G-361, New York 16, N. Y. In Canada, address Canadian Johns-Manville, Ltd., Port Credit, Ontario.

JOHNS-MANVILLE

DURATAPE and DURAMESH are registered trademarks of the Johns-Manville Corporation

JOHNS-MANVILLE JM PRODUCTS

ENGINEERED—TESTED—PERFORMANCE-PROVED

for gas service

Each year, more corrosion engineers specify CAP Insulating Unions for their meter installations. These are necessary to assure maximum service from pipe and equipment. Insulating unions prevent corrosion caused by electrolysis.

Both the Capitol *Special* and *High Temperature* insulating unions are engineered specifically for gas service—performance-proved by years of service without a single failure—tested for assured quality control.

The *Special* insulating union is recommended for normal applications and will withstand up to 250° F (external heat). The *High Temperature* insulating union will withstand 450° F for one hour (the temperature at which solder in the meter will melt). The *High Temperature* union is designed for maximum protection against a gas leak in the event of a fire.

Only CAP gas service insulating unions have all of these features:

- Forged Steel construction—eliminates danger of sand holes or porosity.
- Exclusive Heavy Tapered Insulation—make connections 3-times stronger than light square type.
- Color Coded—for easy identification by service crews . . . orange for *Special* . . . yellow for *High Temperature*.
- Black oxide coated to prevent rusting.
- Two-thirds insulating unions, *Special* and *High Temperature* are available.

ALL FORGED STEEL for maximum tensile strength—no porosity—no sand holes.
TAPERED INSULATION assures 3-times stronger connections than light square type.
INSULATING is tested and proved effective, long-lasting.
NATIONAL PIPE TAPER for tighter joints.

Add to the life of your company's piping and meters by using CAP Insulating Unions on all installations.

CAP *Special* and *High Temperature* Insulating Unions

Size	Overall Dimensions	Special Part No.	High Temp. Part No.	Quantity in Carton	Approx. wt. per 100
¾"	2.27"	GS-33	GHT-3	20	72#
1"	2.89"	GS-44	GHT-4	12	110#
1¼"	2.96"	GS-55	GHT-5	10	150#
1½"	3.07"	GS-66	GHT-6	5	220#
2"	3.48"	GS-77	GHT-7	5	340#

CARTONED:

Packaged in small cartons for easier handling, better protection, save time and reduce inventory losses.

CONVENIENTLY CARTONED for easier handling and better inventory control.

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

SPECIFY CAP FOR ALL FITTINGS

CAPITOL

CAPITOL MANUFACTURING CO.
Division of HARSCO Corporation, Columbus, Ohio

Quick quiz tells whether you're paying more than you need for Gas Distribution Pressure Recorders

YES	NO		
☐	☐	Can you get easy-to-read 12" charts without paying extra?	from Foxboro you can!
☐	☐	Can you get a fully weatherproof case without paying extra?	from Foxboro you can!
☐	☐	Can you get a 100% submersible case for flooded areas?	from Foxboro you can!
☐	☐	Can you get one standard recorder for both permanent and portable applications?	from Foxboro you can!

A check in the "NO" column means you should read Foxboro's Pressure Recorder Bulletin. Write for your copy today. The Foxboro Company, 343 Norfolk Street, Foxboro, Mass.

FOXBORO
REG. U.S. PAT. OFF.

NOW... X·TRU·COAT

the new polyethylene coating to prevent pipeline corrosion

FROM HILL HUBBELL

the name synonymous with
quality pipe coatings and wrappings

If you are responsible for specifying pipeline protection, or keeping your pipelines as trouble-free as possible, then you'll find the above announcement important for two reasons.

First, because of the many desirable features inherent in high-density polyethylene X-Tru-Coat. *It has proven ability to resist a wide variety of soil conditions. It can withstand severe bending and flexing without damaging the protective continuity of the coating. It is easy to handle and install. Initial sizes: ¾" nom. to 5 9/16" O.D.*

Second, because Hill Hubbell, a pipeline protection specialist, offers special benefits.

Any manufacturer's pipe can be coated. Strategically located plants of foremost technical design provide unmatched nationwide delivery. Buy pipe at your advantage and store in Hill Hubbell's yard until required on the job. Flexibility of specifications, scheduling and shipping can be tailored to your requirements. Only the finest materials are mill-applied under carefully controlled conditions. Factory to field assistance is always available.

These benefits are yours with *Hill Hubbell X-Tru-Coat* or one of the more than 30 other Hill Hubbell corrosion-control specifications.

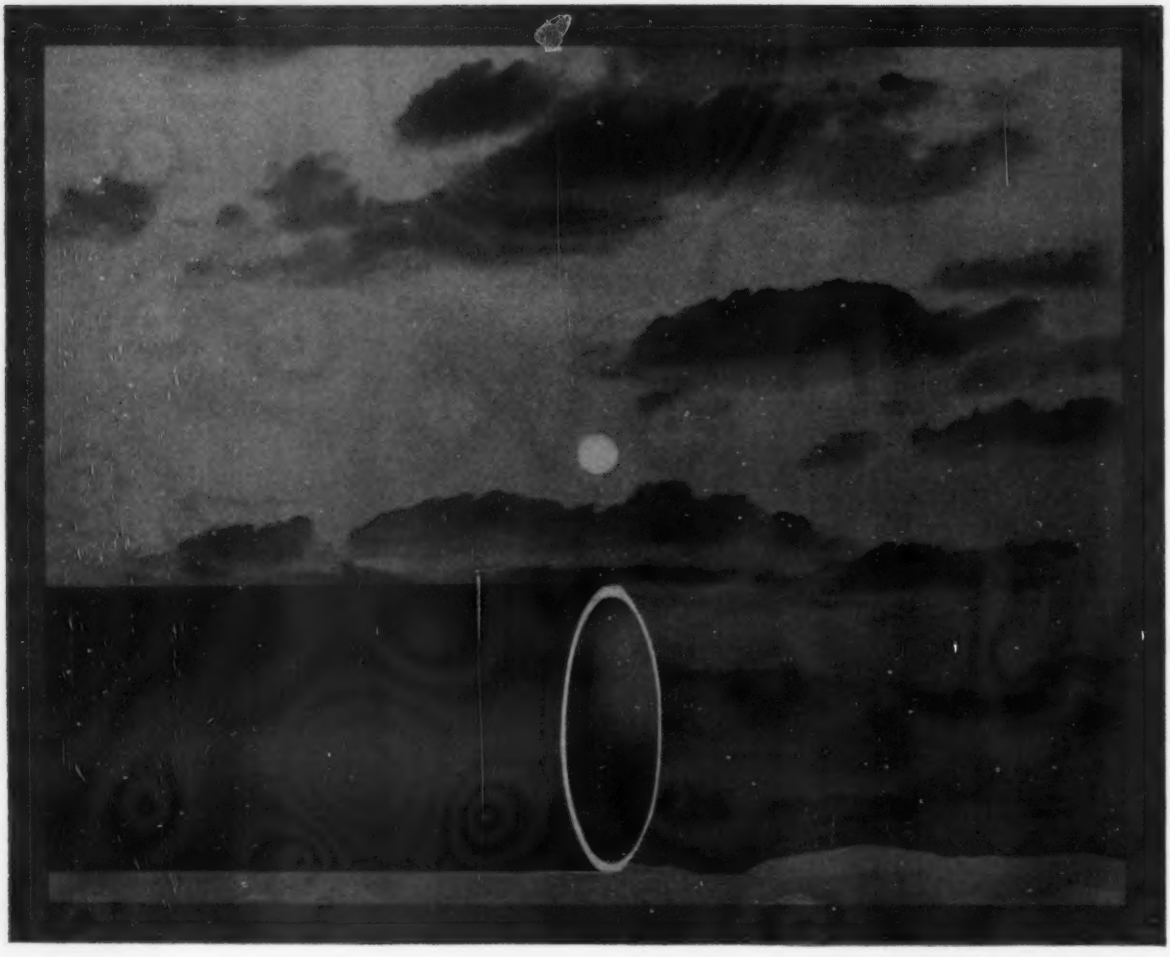
Specify ***Hill Hubbell X-Tru-Coat*** *or other high-quality coatings mill-applied by Hill Hubbell, on your next job.*

HILL HUBBELL

3091 MAYFIELD RD · CLEVELAND 18, OHIO · YELLOWSTONE 2-7535

Hill Hubbell X-Tru-Coat is produced under the Dekoron® process.

Naugatuck KRALASTIC W



Not the end...just the beginning

Kralastic® pipe has proved successful in over 16,000 miles of installations... a tangible indication of this original ABS resin's dependability and durability. However, this isn't the story's end, for Naugatuck has developed a new and more promising resin—Kralastic W.

New Kralastic W has a wider temperature range, providing better low-temperature impact strength... greater superiority of performance in sub-zero areas... more versatility in extruding operations. In addition, pipe made with Kralastic W has greater built-in protection against fatigue rupture in long-term use, coupled with excellent chemical and electrical properties.

Kralastic W is available in commercial quantities. Write for full details and see why Kralastic is not only the top plastic piping material on the market, but the most reliable of all piping for gas distribution, potable water, fittings, electrical conduit, and other pipe applications.

United States Rubber
NAUGATUCK CHEMICAL DIVISION
DEPT. A, ELM STREET, NAUGATUCK, CONNECTICUT
KRALASTIC ABS RESINS • **MARVINOL** VINYLS • **VIBRIN** POLYESTERS

DIST. OFFICES: Akron · Boston · Chicago · Gastonia · Los Angeles · Memphis · New York · Philadelphia · CANADA: Naugatuck Chemicals · Elmira, Ont. · Cable: Rubexport, N.Y.

EMPIRE

GAS FLOOR FURNACES

ARE EASIER TO SELL

Outstanding value is the reason why Empire outsells all others. Sell more units. Satisfy more customers. Keep more profit! Write today for the complete Empire Floor Furnace sales plan.

AMERICAN GAS ASSOCIATION — APPROVED — CERTIFIED

MEMBER NATIONAL LP-GAS COUNCIL

Empire

PACESETTERS IN QUALITY, COMFORT AND ECONOMY

MAIL THIS COUPON TODAY
EMPIRE STOVE COMPANY • BELLEVILLE, ILL.

Send information on Floor Furnace Sales Plan.

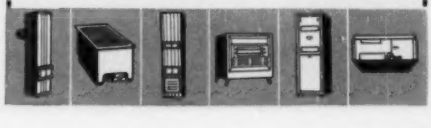
NAME.....

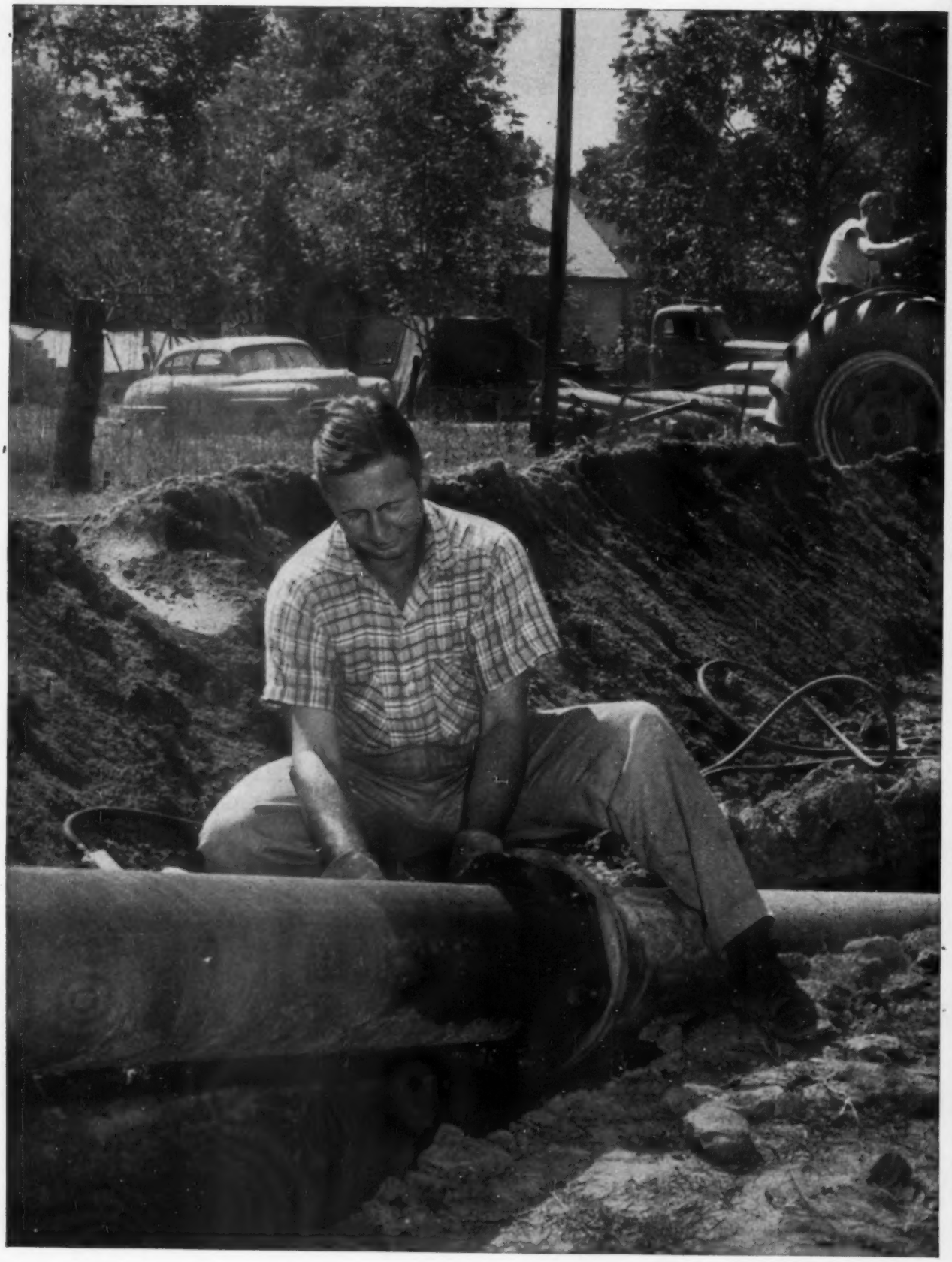
DEALER NAME.....

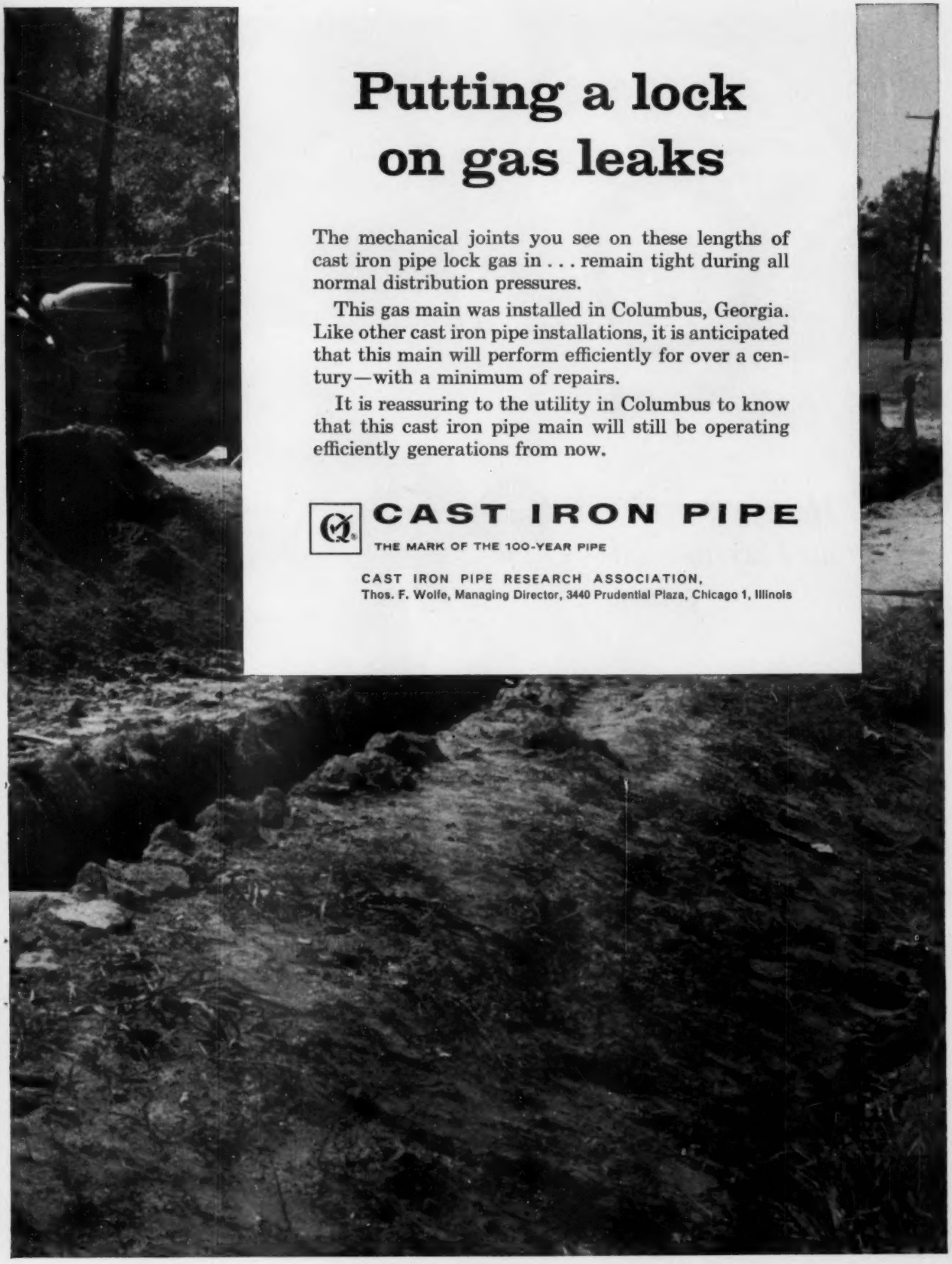
DEALER'S ADDRESS.....

CITY.....

ZONE.....STATE.....







Putting a lock on gas leaks

The mechanical joints you see on these lengths of cast iron pipe lock gas in . . . remain tight during all normal distribution pressures.

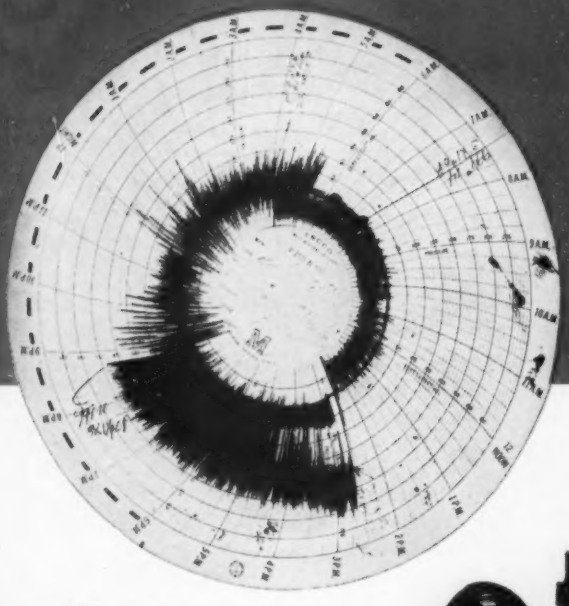
This gas main was installed in Columbus, Georgia. Like other cast iron pipe installations, it is anticipated that this main will perform efficiently for over a century—with a minimum of repairs.

It is reassuring to the utility in Columbus to know that this cast iron pipe main will still be operating efficiently generations from now.

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

CAST IRON PIPE RESEARCH ASSOCIATION,
Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois



Are "paint brush" charts like this your problem?

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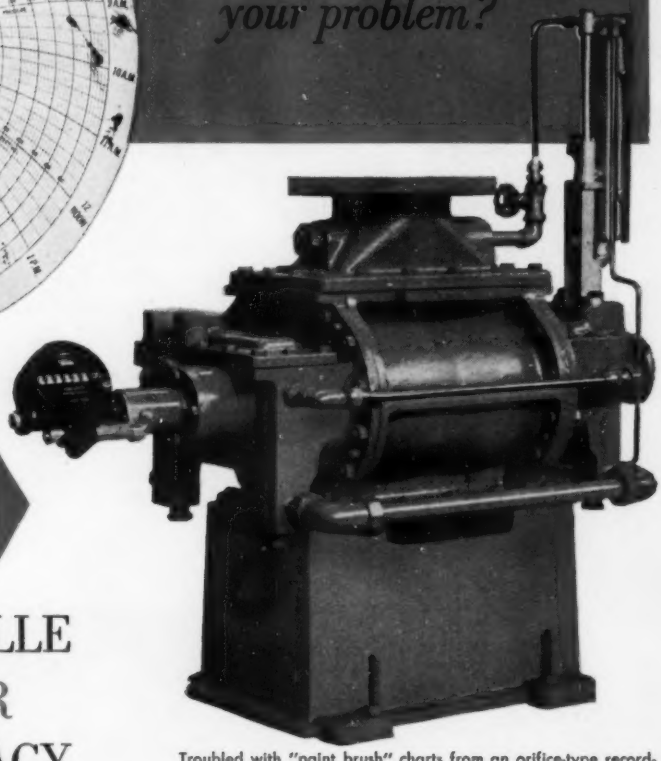

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GAS

MARCH 1961

Corrosion expert Marshall Parker makes several predictions on pipe protection developments in the coming decade, beginning on the following page. His forecast is followed by a discussion of "Material Studies Relative to Corrosion" by Paul F. Marx. Northern Illinois Gas Co.'s new anode-installation equipment is described on pages 87-88. And, in the Pipeline Section, Eastern Editor William Harper reports on the use of aluminum pipe by United Fuel Gas Co.

CORROSION '61

GAS Magazine's 9th Annual Plastics Pipe Survey reveals that the estimated 859 miles of plastics pipe that will be used in 1961 tops the '60 estimate by 84 per cent. More details on plastics pipe in 1961 can be found beginning on page 89. Operating practices of five utilities using plastics pipe are covered in "Field Reports," beginning on page 89. Two engineers from Phillips Chemical Co. report on the use of plastics pipe in gathering and distribution systems (pp. 135-137).

PLASTICS PIPE

'61

What's ahead

WHAT developments does the coming decade hold in the field of corrosion control on pipe-lines? The last decade held quite a few. Among them:

- Plastic tape, in a variety of forms and systems, and bringing with it the concept of total applied coating cost.
- Epoxy and combination epoxy coatings, not yet in wide use for large-scale application.
- High-silicon cast iron anodes, giving freedom from the absolute necessity of using backfill, difficult as that is in wet and caving soils.
- Self-regulating or constant current rectifiers, thus at least partly compensating for variations in soil moisture.
- Magnetic amplifier circuits, as yet only in limited use, which will make possible the automatic regulation of a cathodic protection system to the desired degree of protection.
- The appearance of low-cost, simple, standardized rectifiers, particularly in small ratings, to take the place of the welter of capacities and ratings formerly available.
- Plastics pipe, as yet only for low pressure and in small diameters.
- Several advances in instrumentation.
- The use of deep anodes, thereby solving knotty problems of high resistivity soil in some areas.
- The use of helicopters in corrosion surveys.
- A great expansion in the number and scope of corrosion-correlating committees—and many others.

The decade also saw a wider acceptance of cathodic protection. No longer looked upon by management as a desperate measure, it is now considered as a matter of course in the initial planning of virtually all gas transmission lines. To a lesser extent, it is also looked upon as a normal procedure in both gathering and distribution systems.

Not all of these developments belong exclusively to the decade immediately past. Some had their beginnings much earlier. Others cannot be considered to have much more than begun.

The same things are true of the developments of the *next* decade, as they are discussed below. Some of these have pretty clearly visible beginnings; some are based on known facts; others on what it is hoped are reasonable extrapolations from present conditions; while some must be classed as pure speculation. They are not arranged in a logical set of categories; they are not in the chronological order of their expected appearance; they are not in the order of their importance, nor of their probability. They appear merely in the order in which they happened to come to mind. Some of these are predictions, while some of them are bare possibilities.

✓ PLASTICS PIPE

Already well established for limited applications, there seems no reasonable doubt that improvements in materials and methods will extend the use of plastics pipe in the future. Costs are still a major factor. It will only be by showing improvement in overall installed costs (including the savings by the omission of cathodic protection) that this material will be able to increase its general market. In some special fields where internal corrosion or product contamination is a major factor, the use of these more expensive materials may be justified. More fantastic developments, such as laying continuously extruded pipe in the field, directly from the extrusion machine, seem to be just that—fantastic ideas, with little likelihood of coming to pass in the foreseeable future; not because they are impossible, but simply because they cannot compete on a cost basis with more conventional and almost equally satisfactory methods.

✓ ALUMINUM PIPE

Already in use in some applications, and more expensive than steel, aluminum must justify its use by other advantages. Among these are possible savings in construction and installation costs, which would lessen or eliminate the cost differential; smoother interior surface, with consequent lower friction losses;

in pipe protection?

By MARSHALL E. PARKER
Consulting Corrosion Engineer, Houston

relative freedom of attack by some products. Aluminum is subject to soil corrosion, suffering a pitting type of attack which is generally similar to that experienced on steel, although there are some interesting differences. It can be protected successfully by cathodic protection, although here again there are some interesting differences in behavior when compared to steel. There might be some small savings to be had in the coating of aluminum pipe—if it is weathered, but clean, tape can be applied without any cleaning operation, which is not true of weathered steel pipe.

Already in use, and increasing, in water flood and similar operations, there seems little doubt that aluminum pipe will find some application in the gas industry, on an appreciable scale, in the near future; when the application comes, we will know how to protect it adequately.

✓ COATINGS

Will we see the development of the "wonder coating?" To fill such a description, it would have to be something with physical characteristics which have been foreshadowed by the epoxies; a material which could be applied to carefully prepared pipe at the mill, and which would have such properties of hardness, flexibility, and environmental resistance that the pipe could then be shipped, handled, bent, welded, and otherwise handled just like bare pipe. Truly the contractor's dream, a coating with these properties would mean great savings in construction costs. Part of this saving, of course, would be available to pay for the extra cost of the coating over presently acceptable materials.

How good would such a coating have to be? It would not have to be perfect, if indeed there is any such thing. It could be actually, a great deal worse—from the standpoint of total electrical conductance—than conventional coatings, provided that it saved enough in total installed cost to pay for the additional cathodic protection required. It is conceivable that such a coating might go into the ground with a somewhat higher conductance than conventional coatings, but then exhibit such a superior resistance to soil stress and rock damage that, at the end of 10 years it would be much better than conventional coating at the end of the same period. All we should ask of any coating being considered for general use is that it be reasonably stable, and that its conductance be such that it can be cathodically protected. Given these, we can then evaluate the total cost of installation plus cathodic protection over the life of the line, and arrive at a rational basis for comparison.

✓ FUEL CELLS

One of the best bets in the entire list is on the development of fuel cells for cathodic protection. These devices will directly convert gas from a transmission or distribution line and oxygen from the air into direct current. It is to be expected that such installations will be made, while the equipment is still much more expensive than the rectifiers we now use, at isolated locations on transmission lines, where no power is available. Then, as costs come down and reliability goes up, they may be useful in other locations as well. Eventually they should develop to the point where we can have complete freedom from power lines, and be able to choose our locations for drainage-points in terms of what the line needs and the soil resistivities available. Freedom like this will make it easier to keep our anodes away from foreign lines, as well as to use more and smaller drainage units, both of which conditions will go far to minimize interference problems.

Of course, the implications of a fuel cell which will produce electric power economically by direct consumption of gas from a line are vastly broader than the mere cathodic protection of that line. They would open up a whole new category of markets for gas—but this is a digression which ought not to be explored here.

✓ SOLAR CELLS

Solar cells do not appear very promising for cathodic protection energy sources. Regardless of how efficient they may become—and they have a long way to go—they will always be subject to the limitation of only generating when the sun is shining, and so would have to be combined with some kind of storage battery to provide continuous protection. It is true, of course, that there are pipelines which do not carry a fuel supply as do gas lines. There just might be a field of application for solar cells on such lines.

✓ ATOMIC CELLS

These appear much more likely to become practical. Their development to the point of usefulness will probably take longer than will be the case for fuel cells, but their complete freedom from dependence upon any sources of external power make them even more generally applicable than fuel cells. A practical atomic cell—generating direct current power by direct conversion of atomic energy—would bring to all kinds of pipelines the flexibility of cathodic protection design which fuel cells will bring to gas lines. Whether they would compete with fuel cells in gas lines would depend on relative costs.

✓ CONSTANT CURRENT RECTIFIERS

Already introduced, constant current rectifiers are now available in a design whose cost is comparable to the standard variety. Further improvements in performance may be expected, as well as further comparative decreases in cost. Actually, the development to be expected is not so much the introduction or even the improvement of the constant current rectifier as is its more widespread acceptance and application. The equipment is available. What is lacking is a proper appreciation of its usefulness and applicability.

The present tendency is to think of the constant current unit when the structure to be protected contains, or is immersed in, water which may vary from fresh to brackish to salt. These are extreme cases, it is true, and the need for the special unit is greatest here; but it is applicable also in the extremely large number of anode beds in soil, where seasonal variations in soil moisture can cause fluctuations in total anode resistance over a range of four to one or more.

✓ CATHODIC PROTECTION WITH AUTOMATIC CONTROL

Automatically controlled cathodic protection systems, which vary their current output to agree with the varying needs of the protected structure, are in operation at the present time. They have, to date, been limited almost exclusively to structures occupying a limited total area, such as tanks and vessels. The difficulty is one of communication. On a pipeline, we should like to vary the output of a rectifier—or similar power source—to maintain a constant pipe-to-soil potential at a point along the line which might be 40 miles away. Sensing elements are readily available, to "observe" the pipe-to-soil potential. Also available are control circuits which, given the data from the sensing element, can control the rectifier output according to the indicated needs. What is lacking is an economical means of communication between the two.

Since pipelines no longer build telephone or telegraph lines along the right-of-way, this formerly handy circuit is no longer available. Microwave telemetering is expensive, especially since neither the rectifier nor the sensing unit is likely, except by chance, to be adjacent to a communications station. There remains the pipe itself. Some early experiments aimed at using a well-coated pipeline as a telephone line came to grief (Lord Kelvin could have explained why) but there is no reason why such a conductor cannot carry intelligence in the right kind of code, even if it can't carry voice frequencies. What is needed is a pulse code, and the pulses can be long and generously spaced; this is not a problem which requires *rapid* communication.

✓ TELEMETERING

Of course improvements in radio communication facilities may be such as to reduce the problem just discussed to a triviality, and, at the same time, may open up so many additional channels that every reading taken by an engineer or a technician in the field will be instantly recorded in the office. Even his movements and thus his location may be automatically recorded in this manner. Nor is there any reason to limit this operation to portable instruments. Permanently installed equipment can transmit, periodically or continuously, the values of important parameters from a set of critical locations—the same sensing element that controls the rectifier can transmit its reading to a central location. What may be done with it there is a matter for further speculation.

✓ MONITOR

On a somewhat less lofty plane than the foregoing, there should be an increase in the use of monitors, or indicating pipe-to-soil voltmeters, at critical points on lines under cathodic protection. Such points are, for example, conveniently accessible road crossings at or near the electrical mid-points between rectifiers. If pre-determined target potentials are maintained at all such points, it can reasonably be assumed that the whole line is under protection. These instruments—which are already available—are permanently installed and completely self-contained. They require an engineer, and additional instrumentation, for initial and periodic calibration; but for long periods of time they may be read by any properly instructed company personnel. These readings, at weekly or monthly intervals, mailed in to a central office *and properly studied*, are of great value in maintaining adequate protection between annual or biennial surveys, and in spotting trouble when it first develops. With some possible improvements, these instruments deserve more widespread consideration and use than they now receive.

✓ RECORDING PIPE-TO-SOIL METER

Another device which would be useful in survey work, is a self-contained, completely portable record-

ing pipe-to-soil voltmeter. A current requirement survey, for example, could be made by first connecting a set of these to properly spaced test leads. They could be set to record continuously from installation to removal, or they could be timed so that all would start up at the same time. As soon as they were all operating, a set of increasing values of current could be drained from a selected point; each value would be left on for a definite period of time, and these would be separated by "off" intervals, all properly recorded. A study of the charts would then yield the data for a very complete current requirement survey. Much travel time would be saved, as the method described involves only one round trip along the line, as contrasted with two to four by the present methods.

A similar procedure would be useful in surveying an existing system, particularly if it had been neglected and was badly out of adjustment. Even greater savings in time and effort could be made in the investigation of interference problems by the use of a number of such devices.

✓ MULTI-POTENTIAL INSTRUMENT

In the study of stray current problems, there is an instrument already in existence which is deserving of wider application. This is basically a set of capacitors, each connected to the terminals where there appears a potential of interest to the study. At the push of a button, all of these circuits are geared simultaneously, so that the whole set of potentials is "frozen" as of one particular movement. In its present form, the device is limited to a set of potentials appearing at terminals which can all be reached by leads from a central point. If this principle of simultaneous reading of a number of values could be extended to those at a distance, it would be still more valuable in this difficult stray current area.

At first glance, it would appear that a set of recording meters, as previously described, would serve the same purpose. Although this is theoretically true, the rapidity of the fluctuations in many stray current problems is such that a very high chart speed, approaching oscillograph speeds, might be required; and even then, exact synchronization would be difficult. A set of such high-speed recorders, *with remote control starting and stopping*, might overcome these difficulties.

✓ LINE CURRENT METER

Of great value in the study of cathodic protection, stray current, and interference problems would be an instrument with which one could read directly the current flowing in a pipeline. Present practice requires reading, with a sensitive millivoltmeter or potentiometer, the very small IR drop between two test leads installed on the line, usually at least 100 ft apart. Readings are thus normally limited to locations where test leads have been installed; an investigation may easily require readings in other places. How such an instrument would work is difficult to predict—but the current is there, and it should be possible to detect and measure it.

Line current can be measured with a "zero resistance ammeter" circuit; but this requires four connections to the pipe, which is no improvement over the calibrated section method. Given a galvanometer of sufficient sensitivity, however, the four can be brought together into a short span, until difficulties are encountered with non-uniform current distribution around the pipe. This problem has not been studied extensively; it may contain the germ of a solution.

Another possibility might lie in the detection of the magnetic field of the current, somewhat in the manner of the clamp-on ammeter. Two problems confront us here, however. The magnetic field of a small *direct* current is much harder to detect and measure than is that of an *alternating* current. Also, the magnetic field of a pipeline current, unlike that in a copper line, is largely confined to the pipe itself, because of the magnetic nature of its material.

✓ CONTINUOUS POTENTIAL SURVEY

A beginning has been made in this field, with a "bicycle wheel" copper sulfate electrode and a recording meter, to obtain a continuous pipe-to-soil potential profile of a pipeline. The importance of such complete coverage has not always been realized; it has been assumed that the potential at a few widely spaced points, particularly on a well coated line, gave an adequate picture of the line as a whole. Recently, however, it was found that, on a well coated line, there were short sections (10 to 20 ft) as low as 600 millivolts within one mile of a rectifier, although every test point—spaced at half mile intervals—over the 40-mile span between rectifiers, showed full protection above 850 millivolts. It is true that these short stretches proved to be areas of severe coating damage lying in extremely dry, porous, high resistivity soil —not actually subject to any corrosion, but isolated from protection. Nevertheless, it is disturbing to find that such conditions can exist; in the light of these possibilities, it appears that if a reasonably economical means of conducting a continuous pipe-to-soil potential survey were available, one would be justified at least once on each cathodically protected transmission line.

✓ CONTINUOUS RESISTIVITY SURVEY

In the "hot spot" system of protecting bare lines with galvanic anodes, a detailed knowledge of the soil resistivity along the line is needed. This not only tells us where protection is needed and how much. It also supplies data necessary for the selection of anodes sizes and prediction of anode life. Present practice calls for a series of four-point resistivity readings along the line, at some nominal spacing such as 200 ft, with "doubling back" as may be needed to locate abrupt resistivity changes. It is obvious that, if it could be obtained without excessive costs, a continuous resistivity profile of the line would be much better. Since resistivity can at least theoretically be measured without even contacting the earth (by high frequency absorption), it does not seem unreasonable to suppose that an instrument to perform such a survey could be devised. After all, the idea sounds much saner than that of an airborne magnetometer—and this is in everyday use!

✓ CONTINUOUS LINE CURRENT SURVEY

It is even possible to conceive of an instrument which travels inside the pipe propelled by the gas, just as a scraper is propelled. Sets of contacts would pick up the IR drop in a short length of pipe and record it, as a function of pipe distance, on a tape or film. If the drop in a foot or two of pipe is too small to measure accurately, it should be possible to use two contacting units connected by a cable, as much as a hundred feet apart, or whatever is needed. The closer spacing is much to be preferred, however, to avoid missing many small local cells completely.

The derivative of the function thus recorded would be current gain or loss, and would thus correlate highly with corrosion activity. This derivative could be obtained by mechanical or electronic differentiation.

Should it prove possible to record the IR drop connected with the very short distance, then it might also be possible to measure and record the minute potential differences associated with local cells, in which a typical anode is on the bottom of the pipe, with the cathode on top. It would be helpful, but not essential, in such a case to maintain orientation with a gyroscope so as to be able to identify the bottom of the pipe.

The usefulness of this device would be enhanced if it could be made simultaneously to record inclination in the fore-and-aft sense; this would make it possible to correlate the record with a profile of the line, and thus to locate points of interest more accurately.

✓ CASINGS

A field in which some improvement is certainly long overdue is that of cased railway and highway crossings. Short circuits between pipe and casing are probably responsible for more local failures of cathodic protective systems than any other single cause. It is true that much of the difficulty is due to the use of inferior pipe supports, or to the improper use of good ones; so an improvement in the discrimination with which they are selected and the intelligence with which they are used would in itself be a development greatly to be desired.

At least one fault here must be laid at the doorstep of the manufacturers. Their recommended spacing for pipe supports is based on the load-carrying capacity of the supports, and is not always close enough to avoid accidental contacts between pipe and casing, in the middle of the span between supports. They perform satisfactorily when both pipe and casing are straight, but an unfortunate combination of crooked pipe and crooked casing can cause a contact.

Two other solutions to the casing problem suggest themselves. One is the use of non-metallic casings, if a material can be found rugged enough to withstand the installation methods used. An objection to this approach would be that such a casing, while offering no protection against local cell action on the pipe, might shield it from the cathodic protection it needs. This, incidentally, is what a shorted metallic casing does, although an insulated metallic casing does not block out cathodic protection. If the non-metallic casing were porous, so that when wet it would support electrolytic conduction (as concrete does, for example), then cathodic protection would be able to reach the pipe within.

The other solution would be the elimination of the casing. With the reliability of cathodic protection rising to higher and higher levels, a good case can be made out for the abandonment of the practice of casing rail and highway crossings. It is doubtful, though, that this well-established practice can be set aside in any such period of time as the next decade.

✓ INSULATION

One thing which is certainly needed—not only in pipeline corrosion control but elsewhere—is a good insulator with the mechanical properties of a metal. It should, of course, be available at a reasonable price. Such a material is at present quite unknown, but does not appear much more fantastic than ceramic magnets—magnetic but non-conductors of electricity—which were unknown just a few years ago but are now in service in a number of applications.

✓ PROTECTION BY TELLURIC CURRENTS

Anyone who has had occasion to conduct surveys on well-coated lines in northerly latitudes has observed fluctuation in potential with no visible source. These reach magnitudes of several volts during magnetic storms, and as much as two or three volts when there is any unusual auroral activity. Fluctuations of half a volt are common, with no other activity visible. These are caused by telluric, or earth currents. They are part of the "thunderstorm circuit" the mechanism of which is approximately as follows: there exists a vertical potential gradient in the atmosphere, amounting to a few hundred volts per meter. This adds up to a potential difference of several thousand volts between the earth and the ionosphere, both of which are conductors. Since the atmosphere between them is not quite a perfect insulator, there is a steady, and fairly constant, current leakage between earth and ionosphere. The return path, completing this circuit, is made up of the aggregate of all the lightning strokes in all the thunderstorms on earth.

Since the leakage current in one direction is fairly uniformly distributed geographically, while the thunderstorms are very widely scattered, there has to be quite a bit of current flow here and there on the surface to keep things equalized. These are the telluric currents. Since our pipelines are not quite perfectly insulated from earth, some of this current gets on and off them through the holidays in the coating.

It is difficult to tell just how much current is involved in those lines where it has been observed, but it is clearly enough to change the potential—of at least part of the line part of the time—by significant amounts. Suppose, then, that we took steps to make it as easy as possible for such current to leave the line, but as difficult as possible for it to get in. This we can do by "grounding" the line to low-resistance electrodes, with silicon or germanium diodes—some rectifying element—in the circuit. These grounding electrodes would have to be of steel, or of a material neutral or anodic to steel. If anodic, we would then be supplying some cathodic protection by galvanic anodes. High silicon iron might serve as a neutral

electrode in this application; zinc or magnesium would, of course, be anodic. Carbon or graphite would not serve; their potential would oppose the discharge of current. The difficulty of getting in we shall leave up to our excellent coating. It seems plausible that, for lines in the right location and having the right orientation, this might result in cathodic protection. Of one thing, though, we can be sure; even if we use all the thunderstorm current, we shall still need more; for the whole earth-ionosphere current amounts to about 1800 amperes, and there is one cathodic protection system that uses six times that much!

✓ MATHEMATICAL ANALYSIS

One development to be expected is not so much a new development as it is a continuation of a trend already well established. This is the increased use of methods of mathematical analysis in the solution of problems in cathodic protection design, stray current and interference mitigation, and related fields. Cut-and-dry methods were good enough in the old days, but now most of the "big profit" corrosion problems are gone. When we could save $50 by spending one, it didn't make much difference if we did it inefficiently by spending five; but now that we are saving five when we spend one, we need sharper pencils. Later on, when we spend $1 to save $1.50, we will really need to know what we are doing.

This is just exactly what mathematical analysis, in an engineering problem is; knowing what we are doing, in precise figures; volts, amperes, dollars and cents. And, as more and more of our effort is necessarily spent on the marginal problems, we shall increasingly need to know, with increasing accuracy, what we are doing.

✓ COMPUTER DESIGN OF CATHODIC PROTECTION

There is no very good reason why the design of a cathodic protection system could not be done by a properly programmed digital computer. Into the machine would go two categories of data.

First, the specific data pertinent to the problem at hand. These would include: the electrical characteristics of the line, as determined by a survey (which might itself have been analyzed by the computer); soil resistivity data for each of the locations considered likely to be suitable as rectifier sites; and information as to the cost of various materials and equipment to be used in the system (anodes, rectifiers, cable of various sizes, etc.), the cost of various operations such as anode installation, cable ditching, rectifier connecting, and other such costs as right-of-way at the various sites, power rates, etc.

The second category would be the program itself; instructions to the machine as to the detailed steps to be followed in selecting, from the available data, a set of rectifier installations whose total annual cost would be the minimum. This program would have to include a number of sub-programs; the attenuation equations, formulae for the resistance of anode groups, and the like. All of these data, supplied to the computer in the form of tape, punched cards, or whatever is suitable, would emerge in a very few minutes in the form of a list of rectifier installations, with capacity of unit, initial settings, number of anodes, and even the size of cable specified for each installation.

Another kind of system whose design could also be made by computer is that for the hot-spot protection of a bare line by galvanic anodes. Data in the first category would include: soil resistivity data for the line; pipe size or sizes; and anode and installation costs, with right-of-way costs, if any. In the second group, the program, there would be: the desired current density for various ranges of soil resistivity, including the upper limit above which protection is not to be installed; the functional relationship between soil resistivity and current output, for the various sizes of anodes; information as to desired average and/or minimum anode life; and the detailed instructions for solving the minimum cost problem.

Actually, there is one reason that neither of these design problems has yet been programmed for a computer, and it may be a very good reason indeed. It seems quite likely that more man-hours would have to be spent in setting up the program than any we engineers or an organization can anticipate saving over the conventional methods now in use. As long as this is true—or is believed to be true—there is no incentive for anyone to take on the problem of designing a program. At the moment, there seems to be a slightly better chance of its being done for the hot-spot design.

✓ TRANSPORTATION

Some guesses have already been made about improvements in communications which are likely to benefit the corrosion engineer. He may also expect to profit by improvements in transportation. The helicopter has already demonstrated its usefulness in providing access to test leads on a line in the wilds. Six hundred miles of pipeline, almost all of which is totally devoid of access roads, was surveyed by helicopter in nine days. Three were spent flying the line in one direction, taking potentials at approximately 4-mile intervals. Six were required to traverse it in the other direction, conducting a number of interrupted current requirement tests. All of the temporary drainage points were set up by car and truck, at accessible locations; the helicopter took care of the potential readings at the same set of test points used earlier.

The principal drawback to the helicopter at present is its high hourly cost. There seems to be some promise of the development of a small VTOL plane which would also be able to land in very restricted locations but whose operating costs would be much smaller. Such a craft would be extremely useful in coping with such situations as successive test points 4 miles apart by pipeline, 65 miles as the car must travel!

✓ MORE COOPERATIVES

Perhaps some of the more important developments in the next decade will be, not in the field of instruments and methods, but in the equally important field

of attitudes and relationships. Mention has already been made of the growth of correlating committees organized on a geographical basis, for the mutual solution of interference problems. Another step along the same road—a step which has been taken in a few instances—is the establishment of a joint cathodic protection system for *all* of the buried metallic structures within a given area. All of these are bonded together at a sufficient number of places and the entire lot placed under cathodic protection just as if it were under a single ownership.

One of the problems in the administration of such a system is the proper allocation of costs. The division must often be somewhat arbitrary, for a full solution to the problem of where all the current is going can cost more than the inequity of an arbitrary division. If the combined system is large enough, a jointly owned subsidiary corporation may be formed, with a directorate representing all the owners and a technical and administrative staff of its own. It is to be expected that such an arrangement would keep better records and in general do a better job than would a committee-type organization.

A simpler case inspires a simpler solution. Two pipelines, of similar size and comparable coating, occupy the same right-of-way for a number of miles. Several rectifiers serve to protect them through this stretch; half are owned, operated, and maintained by each company. The two lines are solidly bonded together at each rectifier location, and at a few other places where they cross; no attempt is made to regulate, or even to measure, the division of current between them. There is no formal agreement between the two companies; ostensibly each is protecting its own line. The two corrosion engineers have exchanged similar letters, in which each says that "to eliminate interference between our lines, we have, with your approval, installed bonds at the following rectifier locations—." This is a neat, tidy arrangement which accomplishes its purpose and does not stir up any unnecessary trouble in other departments. Several such systems are known to exist.

✓ INTERFERENCE

It can be demonstrated, both by actual field measurements and by mathematical analysis, that interference is possible between structures which are at no point close enough for a bond to be installed. Interference in these cases is generally mild, and, if the threatened structure is under cathodic protection, can be fully controlled by the protective system. These considerations lead to the prediction that it will ultimately be accepted as a principle that the direct responsibility of the operator of a cathodic protection system is limited to those whose structures lie within the anode gradient; to others he owes only the responsibility of adequate notification and reasonable cooperation in carrying out remedial measures under their initiative.

In other words, when you install a rectifier, it is up to you to keep the current from its anode from damaging any nearby structures (even if you have to move the anode)! Your responsibility toward the owners of more distant structures is limited to adequate notification. It is furthermore predicted that "adequate notification" will come to mean notification of the appropriate correlating committee. If, after such notification, an investigation *undertaken on the initiative of the owner of the threatened structure* indicates some remedial measures to be needed, then you will owe him reasonable cooperation in carrying them out. The correlating committee may be the judge of what constitutes reasonable cooperation. Actually, outside the anode gradient, it is seldom necessary to use a bond to protect a cathodically protected structure from interference damage, and the most economical *overall* approach is for each to protect his own; this does not necessarily apply in congested areas, where anode gradients cannot be avoided.

✓ GOVERNMENT REGULATION

An unpleasant alternative to increased cooperation is that of government regulation. None of us would like to see the day come when a government permit is required for a rectifier installation, on the grounds that the current, on its way from anode to cathode is not by any means confined to the acquired right-of-way. The right to use the earth as part of an electrical circuit is well established in law; but the right to do so without regulation is not guaranteed.

✓ MANAGEMENT RELATIONS

The status of the corrosion engineer at present is good. Management, in general, is well aware of the contributions he is making to the economy and to the company's profits, although these good opinions are by no means unanimous. Inevitably, however, he is confronted with what may be termed the "Corrosion Engineer's Dilemma": the better he does his job, and the longer he does it well, the less evident it is that he is doing anything at all! In some future state of affairs, when all of the poorly protected lines have been junked or abandoned; when all existing lines are under the protection of systems which are well and faithfully maintained; there will be no leaks on any of these lines. Under these conditions, how long will it be before someone in management questions the expenditures of the corrosion department?

Although this may appear to be an over-drawn picture, the problem itself is real. It is one which is already familiar to workers in the fields of public health and of accident prevention. The answer, as found by these groups, lies in strong and unremitting publicity, carried out by the individual within his company, and by the whole group as represented by their organization the National Association of Corrosion Engineers.

✓ A WILD PREDICTION

Somewhere, sometime in the next decade, a corrosion engineer, in the normal course of his duties, will be set up at a road crossing in the edge of a small town, taking a pipe-to-soil potential. Two small boys will be watching the proceedings, as an elderly citizen approaches. The latter will observe for a few minutes in silence. He will then turn to the engineer, and he will *not* say, "What'r ye doin', young feller? Lookin' for uranium?" ■

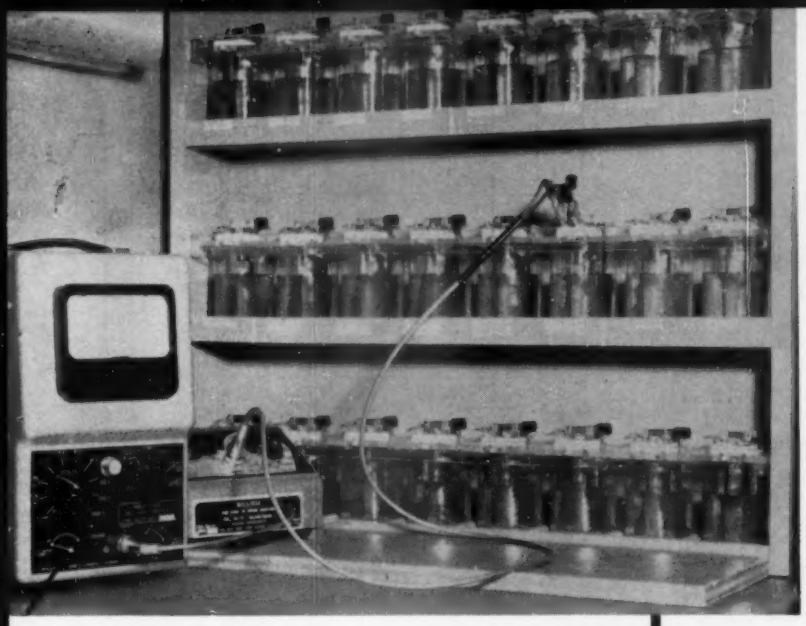


FIGURE 1.

Material study relative to corrosion

By PAUL F. MARX
Dresser Manufacturing Division
Bradford, Pa.

'61

ALL industries have corrosion problems. But, corrosion is more significant in some than in others. Some industries must solve their corrosion problems before they can operate at all. Many more must control corrosion if they are to operate safely and at a profit. Since many Dresser couplings are buried for indefinite lengths of time, anticipation of corrosion is of prime importance to the company.

This report covers certain results in the study of galvanic action of materials which might be used in Dresser products to mitigate corrosion. It is our design purpose to balance the cathodic effect of some materials against the relative areas of various parts, so that those materials having the smallest areas may be cathodically protected by parts having large areas subject to corrosion.

To be specific, it was known that the current formed between the steel bolts and malleable iron in clamps caused the bolt to corrode to protect the malleable iron parts. Primary motivation for these studies was to determine a feasible method of reversing this procedure.

After soliciting the best advice of consulting engineers in the field of corrosion, it was decided to undertake a program of material studies to determine the relative galvanic action of materials suitable for use in the design of Dresser products. After considerable study, four types of alloy steels and two types of low-carbon steels were selected for testing. Selection of these materials was made after many types of steels were appraised. Final selection was based on physical properties, economic considerations, fabrication methods and dependability of supply.

Corrosion can be controlled by cathodic protection. However, in many cases, cathodic protection is impossible and metal parts are bare. In such cases, if galvanic action is causing corrosion, serious damage could be eliminated by making the small area parts cathodic to the surrounding metal. The corrosion of the small area parts would then be retarded.

Galvanic cell tests were set up on the following materials:

Alloy I, II, III, IV	versus Carbon Steel D
Alloy I, II, III, IV	versus Carbon Steel A heat-treated
Alloy I, II, III, IV	versus Carbon Steel A

Alloy I, II, III, V } versus Malleable Iron

TEST DATA

Test data are shown on *Figs. 2-6*. Where the curves are positive, the metal marked "plus" (+) is being protected.

These tests were made by machining pieces of the various materials to a size ¼ in. x ½ in. x 4 in. The two pieces required for each cell were supported separately and insulated by plexiglas. They were suspended in a glass beaker to the same depth with the metal faces 1 in. apart.

The two pieces of dissimilar metals were externally connected, electrically, through a single-pole single-throw switch.

All beakers were filled with tap water to a level which gave an immersion of 2 in. on the metal pieces, as shown in *Fig. 1*.

Immediate and 30-minute open-circuit potentials, together with current flow, were taken with a vacuum-tube voltmeter, bi-weekly for two months, and once per week thereafter. To date, the tests have been running for several years.

The resistance of the tap water used in the test is shown in *Fig. 2*.

Curves were plotted on each cell; however, only the ones of interest are included here.

If a current i flows for a time t and deposits a metal whose electrochemical equivalent is e, the mass deposited is $m = e\ i\ t$.

The value of e is usually given for mass in grams, i in amperes and t in seconds, whence

e = electrochemical equiv. for $FE_2 = 2.8938 \times 10^{-1}$ Mg./coulomb but since we want the mass deposited in #/Amp/yr, the formula resolves itself as shown:

$$m = \frac{2.8938 \times 10^{-4} \times 31536000}{453.6}$$

$$= 20.1\#/\text{Amp/yr}$$

$$\text{From the formula } P = \frac{WK}{SAT}$$

where P = average penetration, inches/year = ipy
W = metal removed = 20.1#
K = constant = 0.1922
S = sp gr = 7.87 gms/cm³
A = area, sq ft but based on 1 cm²
T = time = 1 yr

$$\text{Whence } P = \frac{20.1 \times 0.1922}{7.87 \times 0.001076 \times 1}$$

$$= 456''/\text{yr/amp/cm}^2$$

or based on
1 microampere/cm² = 0.000456 in./year (ipy)
Therefore,
1 microampere/cm² = 0.0005 in. per year.

The area of each anode and cathode exposed to current flow in the cells is 20.2 cm².

In the case of Alloy 1 and the carbon steel A *(Fig. 3)*, the leveling of the current curve to date is around

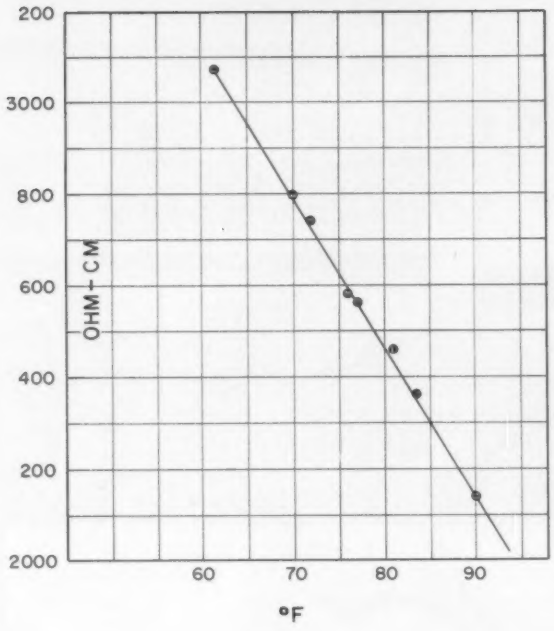


FIGURE 2.

35 microamperes or approximately 1.7 microampere/cm².

If the anode and cathode have equal areas, the anode (in this case being the carbon steel A) would have an average penetration of

1.7 x 0.0005 = 0.00085 in. per year

However, if the ratio of the anode to the cathode be 3.1 ft² : 0.7 ft² or 4.4; the average penetration due to the area ratios would be approximately 0.2 mils per year. These figures are relative areas of middle ring and flanges to bolts of a 6 in. Style 38 Dresser coupling.

For comparison, *Table 1* gives an idea of the average penetration, per year, based on the way the current curves are leveling out.

From this, it can be seen that no adverse effect on the large area parts will be caused by the use of Alloy I bolts. It should also be noted that although the smaller parts are cathodically protected by the larger parts (in this case the bolts and nuts are protected by the coupling and flange), the ratio of total surface areas is high, and where this ratio is not too low, the problem is not serious.

CONCLUSIONS

Alloy 1 vs. Malleable—In many cases, especially bell joint clamps, no cathodic protection is used, and metal parts are bare. In such cases, if galvanic action is causing corrosion of the bolts and can be diminished by making the bolts slightly cathodic to the surrounding metal, with controlled surface area, then the bolt corrosion from this source will decrease and consequently the bolt life will be extended.

After extensive laboratory research, Alloy I was chosen because it is just slightly cathodic to the sur-

FIGURE 3.

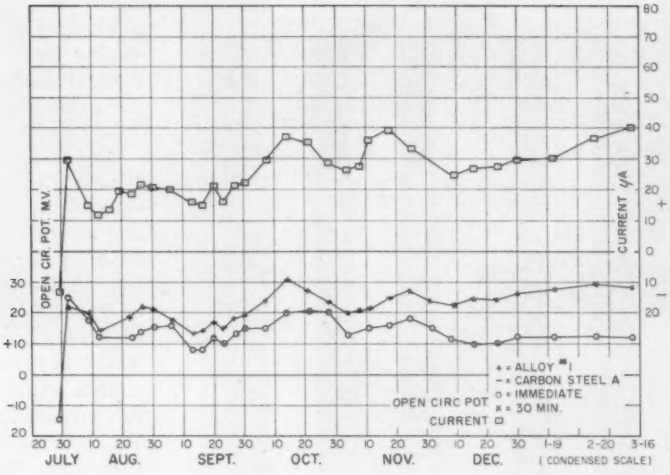


FIGURE 4.

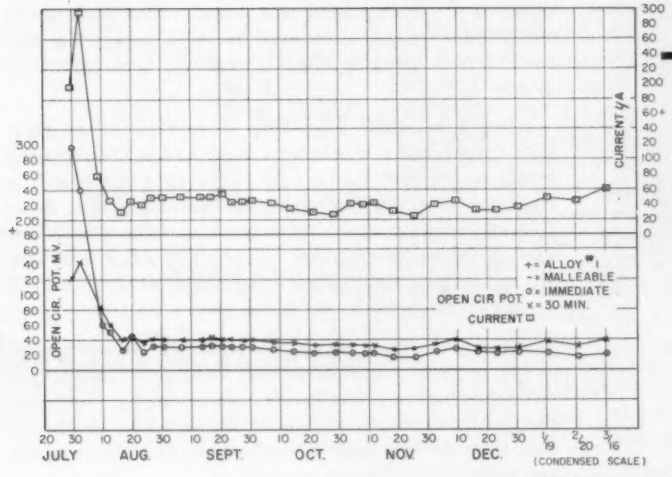


FIGURE 5.

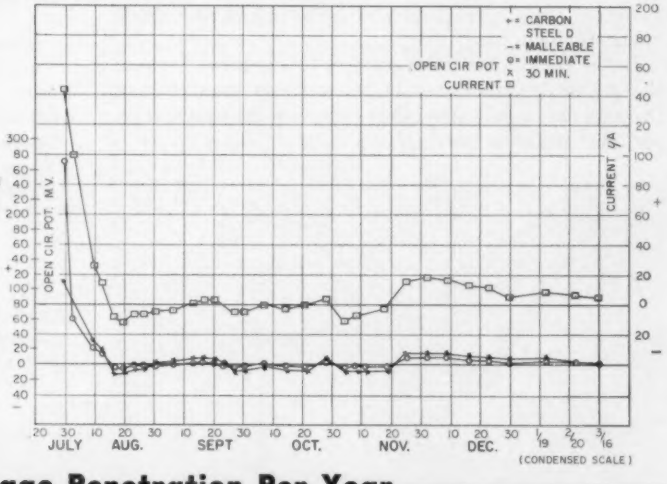


TABLE 1. Average Penetration Per Year

1	2	3	4	5	6	7	8
			Total Surface Area in Sq Ft				
Size	Type	No. Bolts & Size	Cplg. & Flg.	Bolts & Nuts	Ratio 4 to 5	Bolt Mat'l	Ave. Penetration of Cplg. or Clamp Mils/Yr
6″ I. D. ¼ x 5″	Style 38	6–⅝ x 8″	3.1	0.7	4.4	Alloy I	0.2
24″ O. D. ¼ x 5″	Style 38 Bar Foil.	14–⅝ x 8″	10.1	1.6	6.3	Alloy I	0.1
6″ CIP	Style 60	6–⅝ x 5½″	2.4	0.5	4.8	Alloy I	0.2*
24″ CIP	Style 60	12–⅝ x 7″	9.5	1.4	6.8	Alloy I	0.1*

* Based on 30 uA.

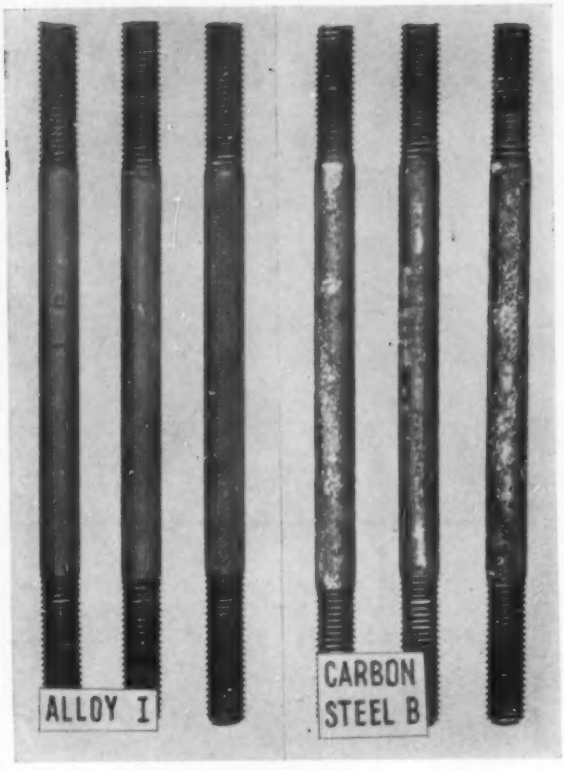


FIGURE 7.

rounding metal in the bell joint clamp. This Alloy I is purposely kept close, in the galvanic series, to the surrounding metal, in order to minimize loss of the surrounding metal, which is also governed by the anode and cathode areas.

In the case of bell joint clamps, this is ideal, because the anode or clamp area is many times greater than the cathode or bolt area, thus reducing the penetration per year proportionately.

The report shows that a 6-in. CIP Style 60 clamp (using the to-date leveling-out points on the current curves) would have a penetration of less than 0.001 in. per year caused by dissimilar metal corrosion, when using the new Alloy I bolt.

The current curve (top curve) in *Fig. 4* shows that the Alloy I (new bolt material) always remains slightly cathodic to the malleable clamp, because it is positive and above the zero datum line.

In comparison, the current curve *Fig. 5* (which represents the malleable clamp and normally used bolt stock) passes back and forth through zero. During the anodic periods (below zero), this bolt stock loses metal, which is never recovered.

This would be similar to the use of malleable bolts in conjunction with malleable clamps, where the galvanic corrosion rate of the bolt is the same as that of the clamp. However, since the bolt area is small compared to the clamp area, the bolts in this case would suffer considerably compared to bolts made of a material which remains slightly cathodic throughout its cycle.

Alloy 1 vs. Cast Iron—*Fig. 6* is attached to show that the Alloy I is slightly cathodic to the surrounding metal in the cast iron sleeve. Note that the graph is consistently above the zero line, indicating that Alloy I is consistently cathodic to the cast iron. Therefore, exactly the same situation exists when Alloy I is used in conjunction with a cast iron sleeve as with Alloy I in conjunction with malleable iron.

Alloy 1 vs. Steel (Style 38 couplings on steel pipe)—*Fig. 3* shows that the Alloy I is slightly cathodic to the surrounding metal in the steel coupling. Note that the graph is consistently above the zero line, indicating that Alloy I is consistently cathodic to steel. Once again, the same conclusion is reached.

Fig. 7 shows Alloy I bolts compared with Carbon steel D bolts installed on Dresser couplings on steel pipe. They were immersed for one year in 170 deg F aerated water. Note the superiority of Alloy I over Carbon steel D. ■

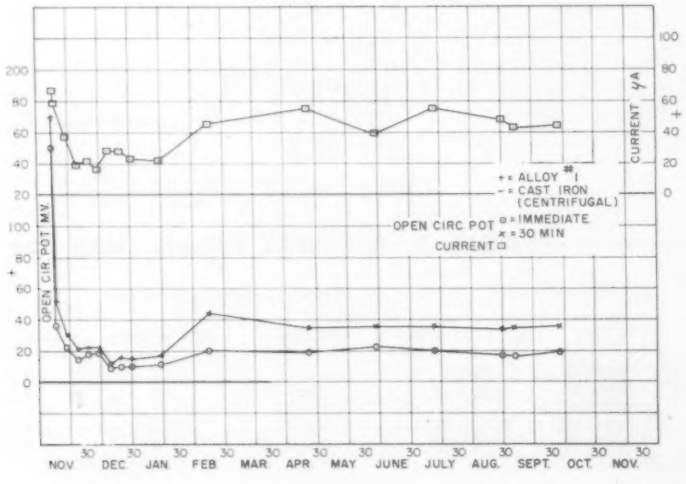

OPEN CIR POT MV
CURRENT μA
+ = ALLOY I
− = CAST IRON (CENTRIFUGAL)
OPEN CIRC POT o = IMMEDIATE x = 30 MIN
CURRENT □
NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV.

FIGURE 6.

New anode installation truck in its on-the-road configuration.

'61

New truck for anode installation

NORTHERN Illinois Gas Co. is taking an interesting new approach to anode installation equipment for cathodic protection operations. Key is a recently designed truck body featuring a boom-hung, hydraulically powered earth auger. The rig is currently undergoing experimental use for evaluation and study.

Up to July 1960, NI-Gas placed most of its anode installation work with contractors. However, studies revealed that NI-Gas crews can accomplish this activity more efficiently. They now use only NI-Gas personnel.

Until development of the new truck body, rather conventional equipment was used to install anodes. This consisted of a truck with a rear-mounted, engine-driven auger. A companion truck went along to bring small tools, anodes and other necessities to the job site. The two-truck unit was handled by four men—two crew members per truck.

The two-truck, four-man system has proved successful and is still being used as a standard practice. However, to further improve anode installation efficiency, the new units are being given a serious trial.

New units have a utility-type body mounted on a conventional truck bed. A hydraulically operated boom is pedestal-implaced high on the curbside rear of the body. The boom can be rotated and extended under hydraulic control. Full boom extension is about 18 ft, permitting anode holes to be bored without moving the truck to the immediate vicinity of the gas pipeline or main.

LEFT: Business end of NI-Gas' new anode installation unit.

RIGHT: NI-Gas crew getting ready to make an anode bore with the new rig.

LEFT: With boom extended, outrigger out, and steadying pad down, auger is ready to make hole.

BELOW: Auger operator takes position on integral seat to avoid being grounded as unit bores away near suspected electric cable.

An auger is suspended from the working end of the boom along with an integral hydraulic motor. A truck-stabilizing outrigger extends hydraulically under the boom. And there is a steadying pad under the off-curb rear fender.

A single man operates the rig from convenient controls installed at the rear of the truck. Included is a dead-man switch which can kill all operation and power in case of an emergency. The operator works from a provided seat when boring in locations where electrical lines and conduit are known or suspected.

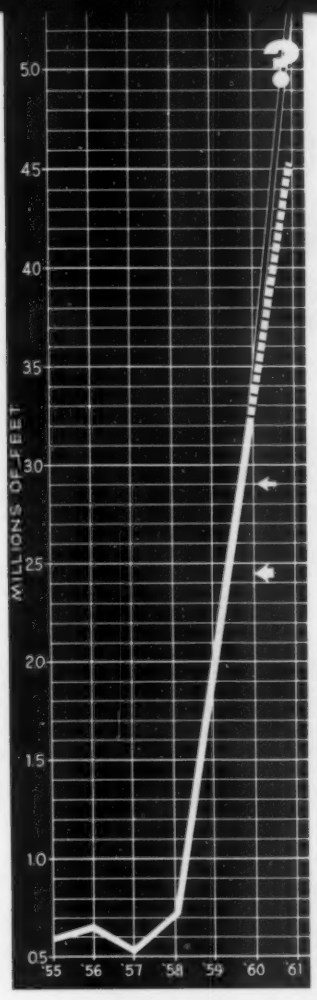
Except for the vehicle's prime power unit, everything is hydraulically driven. A special transmission transfers power from the truck engine to a hydraulic pump and, in turn, to the hydraulic system. A hydraulic motor rotates the auger which pulls itself into the ground to make a bore.

NI-Gas reports that three-man crews can make anode installations with a new unit. A second truck is not required. An average performance to date is eight holes per day, including all travel time. For protection of bare pipe, anodes are installed at a 12-ft depth. NI-Gas specs call for anodes about 2 ft below coated and wrapped steel. Normally, 17-lb "packaged" anodes (sacked sacrificial metal and special backfill) are installed.

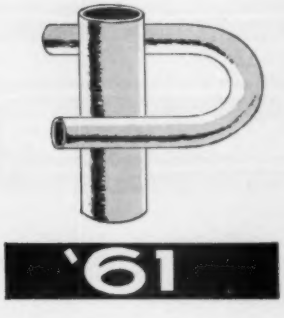
Specifications for the new combination were cooperatively developed by NI-Gas and McCabe-Powers Body Co. The latter company did the basic design and construction of the body, transmission modification, hydraulic system, and installed equipment. ■

ABOVE: After bore is dug, 17-lb packaged anode is installed.

The new truck body and equipment is being evaluated to replace this two-truck anode installation unit (above and right).



Six-year growth chart of plastics pipe usage by distribution companies shows tremendous upward zoom. The solid line is actual usage through 1960. The broken line is the industry's estimate for '61 while the open line indicates actual '61 usage might go much higher. This happened in '60, when usage far exceeded the industry estimate (lower arrow) and GAS Magazine's estimate (upper arrow).



• Estimated '61 plastics pipe usage, 859 miles, exceeds '60 estimate by 84 per cent

Plastics pipe shows plenty progress!

By ROBERT CLAY • Managing Editor

"MAN, look at that kid grow!" That's our summation of GAS Magazine's Ninth Annual Plastics Pipe Survey—inasmuch as we last year described plastics pipe's progress in gas distribution as "an infant (that is) becoming a child."

The growth of plastics pipe in gas distribution *has* been really spectacular during the past 12 months.

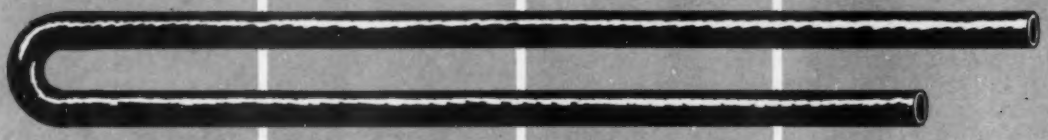
Last year's survey indicated that 2.46 million ft of plastics would be used in '60. Since the industry's estimate had proved conservative the previous year, we estimated — somewhat cautiously — that '60 use might be as much as 2.8 million ft. One reason for the caution was that in view of plastics' past ups and downs on the growth chart, we weren't sure it would sustain two consecutive years of rapid growth. We also suggested—somewhat timidly—that perhaps the time had come to start measuring plastics in miles, not feet. One reason for the timidity was that—although estimated '60 usage was 467 miles—one survey total, the previous year's mains and replacement usage, was only a measly 1874 ft.

This year, the over-all picture is completely different. The '61 survey showed, first of all, that actual usage in '60 was not 2.46 million ft or even 2.8 million ft, but 3.23 million ft. And the estimate for '61 was an amazing 4.53 million ft, a whopping 83.9 per cent increase over the '60 estimate. In mileage, the '61 estimate is 858.7 miles. And, judging from past conservatism, we wouldn't be too suprised if total '61 usage exceeded 1000 miles.

Yet, until just two years ago, plastics pipe in the gas industry had really been in a relative incubator stage. With an average of about 15,000 miles of pipe going into the nation's gas distribution networks each year, plastics pipe accounted for only about 100 miles 500,000 ft) or two-thirds of 1 per cent of all pipe used. In '61, about 14,300 miles of pipe are to be added to gas distribution networks and 858.7 miles of plastic is nearly 6 per cent of that total, a percentage that should no longer be pooh-poohed as insignificant.

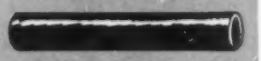
Looking at this annual growth in another way, it

Plastics Pipe Progress



At the beginning of 1960, 62 companies had 1880 miles of plastics pipe in the ground.

During 1960, 45 companies installed 612 miles of plastics pipe:

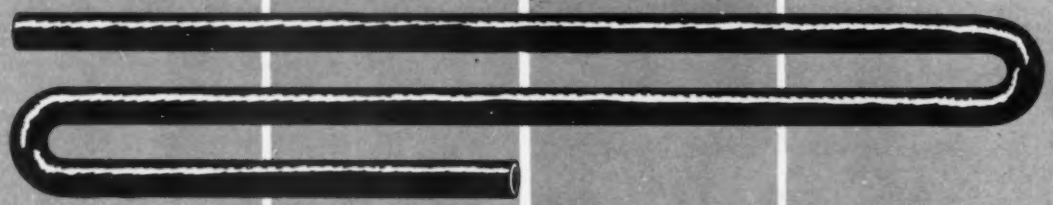


37% of the '61 total, 223 miles, was installed as new mains by 17 companies;

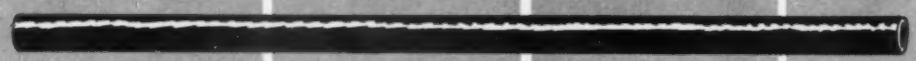
34% of the '61 total, 207 miles, was installed as new services by 24 companies;

28% of the '61 total, 171 miles, was installed as service replacements and insertions by 32 companies;

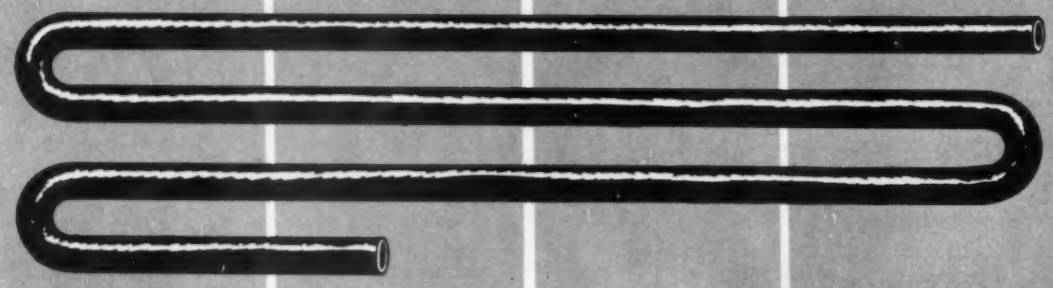
1% of the '61 total, 6 miles, was installed as mains replacements and insertions by 6 companies.



Thus, at the beginning of 1961, 69 companies had 2492 miles of plastics pipe in the ground.

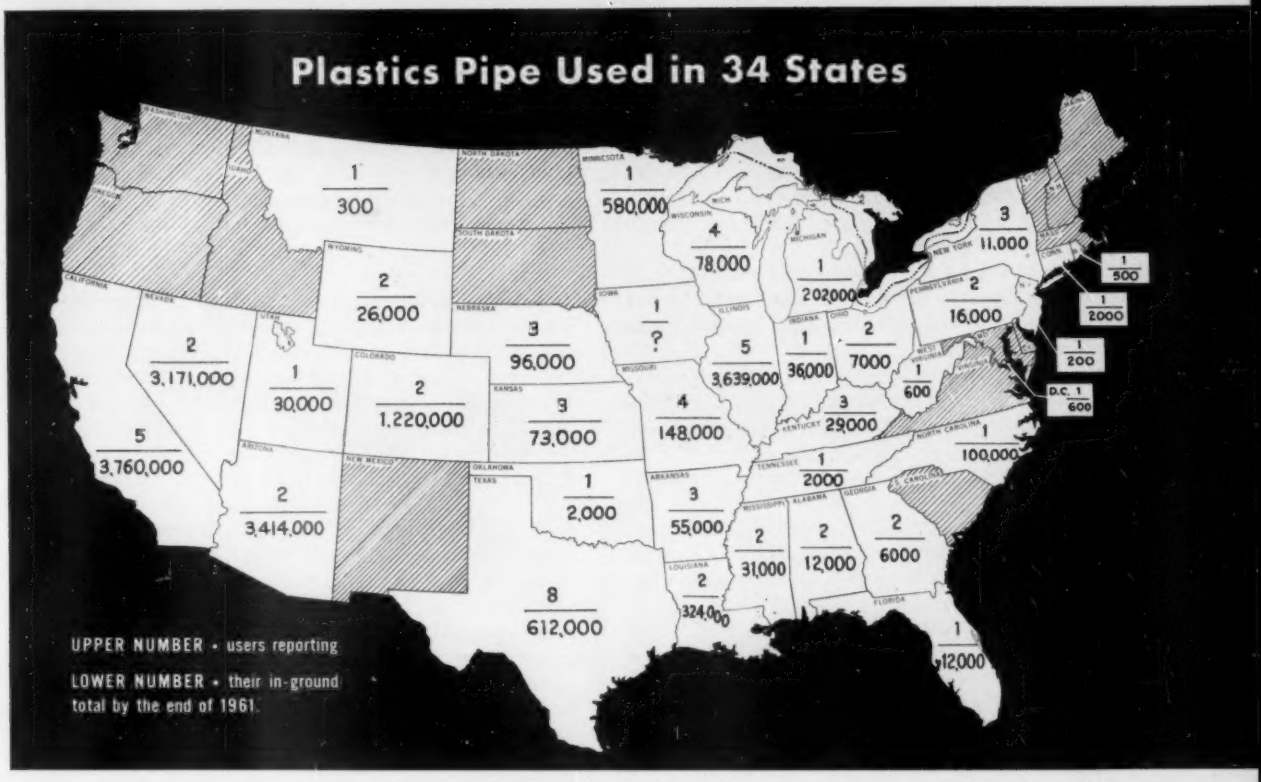


And during 1961, 50 companies will install plastics pipe, 45 estimating usages totaling 859 miles.



So, by the end of '61, 78 companies will have a total of at least 3351 miles of plastics pipe in the ground!

MILES 250 500 750 1000



wasn't until 1959 that plastics broke the 1-million-ft barrier. Then, it did so substantially—more than doubling the previous high with a total estimated usage of 1.60 million ft. Now, just two years later, the estimated annual usage is nearly three times that amount and the largest single user will lay 1.78 million ft this year, more than the entire industry's total in the record-breaking year of 1959.

The actual in-ground growth provides good documentation for this accelerating curve. Until 1959, the amount of plastics in the ground grew approximately 10 per cent per year. In 1959, this rate more than doubled, to 21.0 per cent. In last year's survey, the industry conservatively estimated that the in-ground figure would increase 24.3 per cent during '60. The '61 survey shows that it actually grew 32.5 per cent. Since growth has exceeded expectations year after year, it is possible that this year's estimated increase, 34.4 per cent, will again be exceeded.

A look at the actual in-ground figures is even more revealing than the percentages. It took approximately one dozen years for the first 1000 miles of plastics pipe to be installed, that mark being reached in 1954. Only six years were needed for the second 1000 miles and the third should take just about 18 months. At the beginning of last year, 1880 miles of plastics pipe had been placed in the ground by a total of 62 companies. At the beginning of this year, the figures were up to 2492 miles and 69 companies. And at the end of this year, they will be 3350 miles and 78 companies.

How is all this pipe being used? Let's look at last year's usage, which was 94.6 per cent above the previous year. Included in this percentage gain were jumps of 142.3 per cent in new services, 14.4 per cent in service replacement and insertion, 232.8 per cent in new mains, and 1668.5 per cent in mains replacement and insertion.

Actual usage in '60 was 612.2 miles, or 3,232,253 ft. That's an average of 13.60 miles for the 45 companies installing last year.

To visualize how this pipe was used, mentally divide the total into three fairly equal parts. The largest third, 222.8 miles, was used for new mains. The medium-sized third, 207.2 miles, was for new services. Now, slice a 6.2-mile sliver off the smallest third for mains replacement and insertion. The remainder of that smallest third, 171.1 miles, went into service replacement and insertion. Both new mains and new services each accounted for over 1 million ft, the former with 1.18 million and the latter with 1.09 million. Replacement and insertion services accounted for 0.9 million ft.

A closer examination of these figures leads to two interesting sets of comparisons. First, service replacement and insertion is still the most popular use—32 companies using plastics in that way. New services is second with 24 utilities, followed by new mains with 17 and mains replacement and insertion with 6. Second, per-company consumption for a specific use is highest with new mains. The average company installing new plastic mains last year used 13.10 miles for that purpose. The average utility using plastics for new services used 8.63 miles in that way, while the figure for service replacement and insertion was 5.37 miles. In this group of averages, mains insertion and replacement is, for once, "in the same league" with an average company use of 1.04 miles.

Where is all this plastic used? In 34 states, the District of Columbia, and three Canadian provinces, the survey shows. And, as shown on the accompanying

map, these states are fairly uniformly distributed all around the country—with the two exceptions of the northeast and northwest corners of the nation. The top 10 states in order of in-ground usage (including '61 estimates) are: first, California; second, Illinois; third, Arizona; fourth, Nevada; fifth, Colorado; sixth, Texas; seventh, Minnesota; eighth, Louisiana; ninth, Michigan; and tenth, Missouri.

How many of the 64 current users are satisfied with plastics pipe in operational use? Forty-eight are and only three are not. The rest are experimental users who remain undecided.

Average maximum operating pressure for the plastics pipe systems of these companies was 33.7 psi. Highest pressure reported for a system using plastics was 150 psi.

What kinds of plastic are being used and which is the most popular? Threading our way through the substantial assortment of chemical names, trade names, and mixed-up names (some utilities apparently have as much trouble as we sometimes do in keeping the names straight), we found that—while most of the companies use only one type of plastic, about one out of every seven uses two or even three types. At this point, none of the four types currently in use has a distinct popularity advantage. Acrylonitrile butadiene styrene is used by 23 utilities while cellulose acetate butyrate follows closely with 21 users. Polyvinyl chloride is not too far behind with 15 and polyethylene is used by six.

Looking to this year, nine companies will start using plastics pipe while two will stop using it. Eighteen will increase their rate of installation while seven will decrease it. In almost every case, those decreasing or halting installation are experimenting and are now waiting for the plastics to build up operating experience. A total of 33 utilities said they would maintain the same installation rate, which can mean either that they will install an amount similar to that installed last year, or that they will continue to holp up further installation while they continue to observe the plastics they already have in the ground.

A total of 50 companies said they would install plastics pipe in '61. Five were undecided on the amount. The remaining 45 estimated they would use a total of 858.67 miles or 4,533,800 ft. That's an average of 19.08 miles or 100,751 ft for each user. As indicated earlier, these figures are 83.9 per cent above last year's estimate. They are also 40.2 per cent above last year's use, which exceeded last year's estimate by 31.1 per cent.

Spreading this out among all plastics users, the average user's amount in the ground will go up from 35.6 miles to 44.09 miles during '61. As a means of comparison, the average was 30.32 miles at the beginning of '60.

Taking a closer look at usage by individual companies, we find that—by the end of this year—five companies will have more than 1 million ft in the ground and four of the five will have more than 3 million ft installed.

Leading in in-ground use will be an Illinois utility with 3.46 million ft. This company will use 600,000 ft of plastics in '61, about 10 per cent more than it used in '60. Last year, it inserted more than 100 miles of 1⅜-in. OD Tenite II (cellulose acetate butyrate) in old services and used about 1½ miles for new services. Maximum pressure under which this pipe operates is 6 in. w.c.

Ranking second in total usage is a southern California company which—over a period of years—placed 3.29 million ft of plastic in the ground and has not used any for several years, waiting until it develops more operating experience. To date, this Tenite II has performed satisfactorily under a maximum operating pressure of 55 psi.

Third in total usage is a Nevada company, which will have 3.109 million ft installed by the end of '61. The 600,000 ft used this year will be an approximate 20 per cent increase over '60. Following past trends, this should be all Kraloy (polyvinyl chloride) and should be fairly equally divided between new services and new mains, with a slight edge to the latter. Maximum operating pressure is 50 psi.

Fourth in in-ground totals—and the number one user in both '60 and '61—will be a southwest company whose 1961 usage, 1.78 million ft, will be more than 10 times the total it had in the ground at the beginning of last year. In 1960, the company used 1.16 million ft, more than half of it, 639,000 ft, for new services. Another large amount, 503,000 ft, was used for new mains, while 17,000 ft went for service replacement and insertion. All of this was acrylonitrile butadiene styrene, operating under a maximum pressure of 60 psi. By the end of '61 the company expects to have 3.108 million ft in the ground. It may well have more and end up the year in third place in total usage.

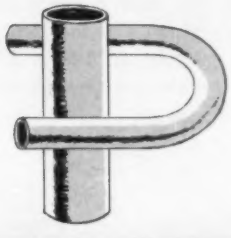
Fifth in in-ground footage at the end of this year will be a Colorado company with 1.17 million ft. In '61, it will use approximately 200,000 ft, about 10 per cent more than last year. Four-fifths of last year's total was for insertion in old services with the remainder for new services. The company uses Tenite II and maintains a maximum operating pressure of 15 psi where plastic is used.

Two midwestern companies appear to be about ready to jump into the large-use category. One had 8000 ft of plastics in the ground at the beginning of last year, used 71,000 ft last year, and reports it will use about 500,000 ft in '61. The other has only 2000 ft in the ground, and used no plastics in '60, but may install 200,000 ft in '61.

Thus, the plastics pipe progress pace quickens. There are several reasons, including plastics' generally highly successful operating record to date and the industry's increased familiarity with the product. One company says one big reason behind its own usage increase is that plastics pipe prices are becoming "very competitive." Another cites the new availability of a wider range of fittings. In most cases, reduced labor and handling costs weigh heavily in favor of the light material.

Acceptance of the material has been such that—right now—at least one large utility specifies plastic for 80 per cent of its new mains and services. Although it hasn't said so, we suspect that another large utility may have an even higher percentage. And more than one large utility is using plastic for virtually all its service replacement work.

At long last, plastics pipe is out of its experimental incubator and is well on its way to achieving a sophisticated identity in the gas distribution world. ■



'61

Field reports from 5 utilities

CENTRAL ELECTRIC & GAS COMPANY

LINCOLN, NEBRASKA

W. E. MICKELSON

Assistant Chief Engineer

CENTRAL ELECTRIC & GAS CO.'S initial use of plastics pipe was in 1952. At that time, one service was installed by direct burial from main to meter post. The plastic was a medium-grade polyethylene normally sold for water use.

Our next use of plastic was in 1955, when 17 test services of Tenite II were installed. Both insertion and direct burial were used.

In 1958, we began using high-density, high-molecular weight polyethylene exclusively. To date, over 10 miles have been installed, approximately five by direct burial and five by insertion.

Late in 1960, we installed 0.8 miles of high-impact polyvinyl chloride, a 1½ in. outlying main extension.

Connections for all plastic except PVC have been made with compression couplings and steel inserts. For renewal by insertion, service-head adaptors are used. The only failure from any cause to date has been the pullout of a service-head adaptor on one of the Tenite II services, believed due to an improperly tightened compression fitting.

The Tenite II used in 1955 become quite brittle during our low winter temperatures.

Polyethylene has proved very tough. Another advantage is that it comes in 100- to 400-ft coils. But it has the disadvantages of being impossible to solvent weld or tap unless the main is taken out of service, and of being a little difficult to work with in below-freezing temperatures.

Our plans for the future are to use both polyethylene and polyvinyl-chloride. Both materials will be used for either mains or services and by direct burial or insertion. We also plan some trial installations of Tenite II.

On new services for outside-meter sets, the plastic will terminate 10 in. below the ground level. A 12-in. radius sweep bend will be used at the service riser on polyethylene service; a PVC elbow on PVC services. The transition from plastic to steel will be by compression fittings on PVC services. Support is provided by a meter bar and bracket fastened to the building.

Except in unusual cases, we do not intend to bury wire with the pipe in order to use a pipe locator. Instead, we plan to keep more-detailed location records.

Distribution systems for a few new communities have been planned for 50 psi. Plans are for two of the communities to consist entirely of PVC. The others are designed for steel mains and polyethylene services.

CITY UTILITIES
of Springfield

HUGH J. TAYLOR, Jr.

Engineer

IN October 1960, City Utilities of Springfield, Mo., installed 2217 ft of plastics pipe for new main and service gas piping. Our intent was to determine if plastic could be satisfactorily used in this locale and how much money could be saved by using it. Because of these objectives, our engineering section closely followed the construction and kept accurate cost records.

For several years we had followed the use of plastic by other distribution companies through the many articles written on the subject. We collected all information available and kept permanent files on the various basic materials and extruders. It was apparent from the beginning that plastic could not be ignored as a prospective carrier of gas.

In 1952, we began using a flexible plastic tubing for renewal of "services" by insertion. This successful application—together with verification of successful uses of semi-rigid pipe by other companies—led us to try a semi-rigid pipe for new mains and services.

Deciding on a basic material was primarily a job

of determining which of the available types had the properties we desired. We considered only three materials: polyvinyl chloride (PVC), acrylonitrile butadiene styrene (Kralastic) and cellulose acetate butyrate (CAB). Our consideration was limited to these three because of AGA Report DMC-56-16. Our files yielded the conclusion that we should use either PVC or Kralastic, because their mechanical properties were more favorable for this type of application and because a complete line of fittings was available for either. After due consideration of the various properties of each, we concluded that neither was so superior that we could eliminate the other on the facts available. It was our decision, then, to choose the most economical. We sent bids to extruders of both materials, again following AGA recommendations regarding pipe size. The bids requested that the extrusion be of iron pipe size with a minimum wall thickness of 0.090 in. and that the material be virgin PVC or Kralastic. After the bids were received, we decided that Type I Kralastic best suited our needs. We purchased enough pipe and fittings to install 3000 ft of 2-in. main and 1500 ft of 3-in. service pipe. At that time, we did not have a location picked for its use.

Stabbing pipe to check the fit before joining.

COMPARATIVE COSTS

Comparative Costs Of Material

	PLASTIC			STEEL	
Item	Amt.	Cost	Item	Amt.	Cost
2" Plastic Pipe	1720'	$667.81	2" Steel Pipe	1741'	$836.55
2" Valves	2	34.70	2" Valves	2	34.70
2" Steel Pipe	21'	10.10	Plastic Tape		12.02
Valve Fittings	2	29.76	Valve Fittings	2	29.76
Misc. Fittings Plastic		37.14	Misc. " Steel		41.04
1 Ton Sand		1.65	Anodes		6.64
Total Cost		$781.16			$960.71
Savings in % equals 18.7%					

Comparative Costs Of Labor

	PLASTIC		STEEL	
Classification		Cost	Classification	Cost
Foreman		$ 115.41	Foreman	$ 115.41
Welder		16.89	Welder	339.64
Serviceman		131.68	Serviceman	131.68
Laborer		169.93	Laborer	169.93
Equip. Opr.		357.99	Equip. Opr.	357.99
Press Cont.		15.44	Press. Cont.	6.78
Total Labor Cost		807.34		1,121.43
Overhead on Labor		209.91		291.57
Total Labor Cost		$1,017.25		$1,413.00
Savings in % equals 28.0%				

Comparative Cost Of Transportation And Equipment

PLASTIC	STEEL
$296.45	$294.55

Savings in % equals –.5%

Total Comparative Cost

PLASTIC	STEEL
$2094.86	$2668.26

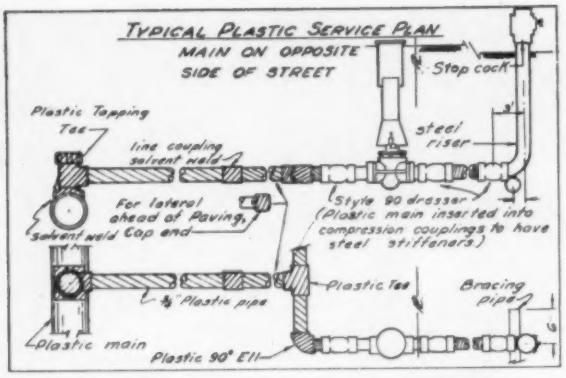
Plastic Cost Per Foot equals $1.20 Steel Cost Per Foot equals $1.53

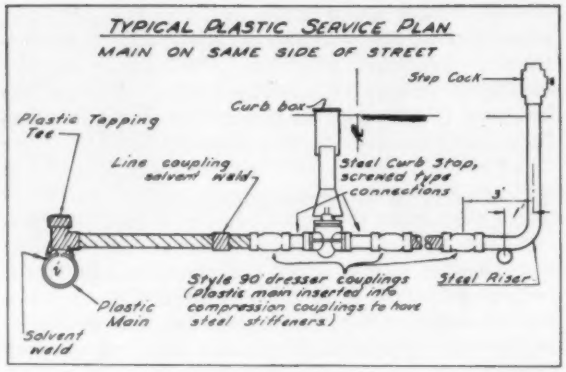
Total Savings in % equals 21.5%

During investigation of the two materials, it was called to our attention that the aging characteristics of Kralastic might be less desirable than those of PVC. However, after contacting some of the experienced users of this material, we concluded that aging is not of major importance when the pipe is stored properly. We did, therefore, take the precaution of keeping this pipe sheltered. We did not know how long it would be in storage.

Since our objective in using plastic was twofold, selecting an area for its installation was of prime concern. We wanted an area which would present common construction conditions but would also present corrosive conditions. Only a few weeks after we received the pipe, a newly platted area requested gas facilities. It was what we were looking for: no construction had begun, the streets were not paved, the pressure was 30 psi with a maximum of 60 psi, the soil was average-mixed type and very corrosive.

At this point, we decided to install service laterals and street crossings ahead of paving and then wait, with the mains until the paving and sanitary sewer crews were out of the way. Because this was a newly platted area, there was no difficulty in dimensioning the location of the crossings to property corner pins. This portion of the project was completed in July 1960. Installation of the laterals was no different than if they had been steel, except that more precaution had to be used in padding the pipe. For the most part, we padded with soil available from the excavation. To keep dirt from getting into the lat-


TYPICAL PLASTIC SERVICE PLAN
MAIN ON OPPOSITE SIDE OF STREET
Stop cock
Plastic Tapping Tee
steel riser
line coupling solvent weld
For lateral ahead of Paving, Solvent weld Cap end
Style 90 dresser (Plastic main inserted into compression couplings to have steel stiffeners)
Plastic Tee
Bracing pipe
Plastic pipe
Plastic main
Plastic 90° Ell


TYPICAL PLASTIC SERVICE PLAN
MAIN ON SAME SIDE OF STREET
Stop Cock
Curb box
Plastic Tapping Tee
Line coupling solvent weld
Steel Curb Stop, screwed type connections
Style 90 dresser couplings (Plastic main inserted into compression couplings to have steel stiffeners)
Steel Riser
Plastic Main
Solvent weld

erals, we covered each end with polyethylene tape.

Actual installation of the main was accomplished by a three-man crew: serviceman, laborer, and equipment operator. To keep the cost at a realistic figure, we used the same number of men as we would have used with steel. An exception to this was that the only welding time charged to the job was the time spent in fabricating the sections of steel at valve locations. This cost was negligible compared to the total cost of labor for the job.

The slowest operation was excavating. Generally speaking, the serviceman and the laborer could join enough pipe lengths in 30 minutes to fill an entire day's digging. This left plenty of available time for them to properly pad the pipe and to keep accurate records of its location.

The location of the main was dimensioned from the curbing of the newly installed paving. We believe this to be sufficient to locate the pipe in the future.

Because of the ease of solvent welding, the men were easily trained. After only a few welds, each man became quite adept. Welding the couplings to the pipe required two men, one to apply the solvent to the inside of the coupling and one to apply the cement to the pipe. This had to be a simultaneous operation because evaporation of either cement or thinner made the joint difficult to complete. At the completion of this operation, any excess cement or thinner was wiped off. We found no faulty or weak joints because of improper solvent welding.

At the end of each day's construction, we capped the end of the pipe. Before joining any more pipe the next day, we pressured-tested the previous day's work. This assured us that no leaks would occur as the result of improper installation. During construction, we did find two leaks, which resulted from injury to the pipe after working hours. Both were definite punctures. The pipe was in an open ditch overnight.

As the backhoe opened the ditch and exposed the laterals we had previously installed, the serviceman and the laborer connected them to the main. This was accomplished by plastic Mueller tapping tees. The tees were welded to both the lateral and main but not tapped out. This allowed us to pressure the main without capping the laterals.

All materials and fittings used were Kralastic except valves and sections of steel around these valves. We took the precaution of installing these sections of steel to eliminate any possibility of twisting the valve from the compression coupling. All steel-to-plastic connections were made by compression because the pipe we used was not recommended for threading and because of the great difference between the coefficients of expansion of the two materials. We originally planned to use socket-type plastic flanges and a steel body valve at these points. However, because of our present policy of using a raised-face gasket, we did not use these flanges.

The only fittings that we had difficulty in obtaining were the steel inserts used for stiffening the plastic at the compression joints. This was strange to us, for nearly all manufacturers' catalogs had service standards which included them. Yet, we were able to obtain these stiffeners from only one extruder.

In establishing standards of construction, we followed very closely techniques used by other companies. However, we did add a brace to be welded on the bottom of the steel riser to give added strength to the steel-to-plastic joint, as shown in the accompanying drawings.

Considering all phases of construction, we concluded that our experimental installation was a success. We are satisfied with the type of pipe and fittings used.

We were particularly pleased with the results of our cost study. We believe the various costs in the accompanying tabulation are accurate and representative of true comparative expenses of steel and pipe. This study represents actual costs encountered in construction of this system and estimated costs for steel in the same area.

As shown in the comparative cost tabulation, the biggest saving was in labor, 28 per cent, or nearly $400 on this job. Material savings, however, were also substantial, 18.7 per cent. Adding in a slightly negative transportation cost factor, the average saving came to 21.5 per cent. Thus, while this experimental plastic installation ran exactly $1.20 per ft, a similar installation in steel would have cost $1.53 per ft.

THE OHIO FUEL GAS COMPANY

99 NO. FRONT STREET COLUMBUS 15, OHIO

P. W. ROGERS

Vice President

FOR some years, the Ohio Fuel Gas Co., along with the other Columbia System firms, has experimented with plastics pipe on company properties and on employees' property, observing its durability and suitability for gas service. Interest accelerated when steel pipe shortages were real or anticipated, then declined when the scarcity was over.

Finally, in the spring of 1960, it was decided to make a pilot installation of plastic mains and services in a new market. The community of North Robinson, Ohio, seemed ideal for this purpose. It has a potential of 100 customers, with 58 initially signed up. There were no underground structures, such as sewer and water lines, or underground cable, and plans indicated no activity of that kind for some years, meaning little or no interference.

It should be mentioned here that in all of our markets, the company service line ends at the curb cock. The customer's service line from the curb cock to the meter is the responsibility of the customer, and is installed by a plumber or the owner at his cost, but according to specifications and test procedures set up by the company. Therefore, only the required intermediate pressure mains and the company service line up to the curb cock would be plastic.

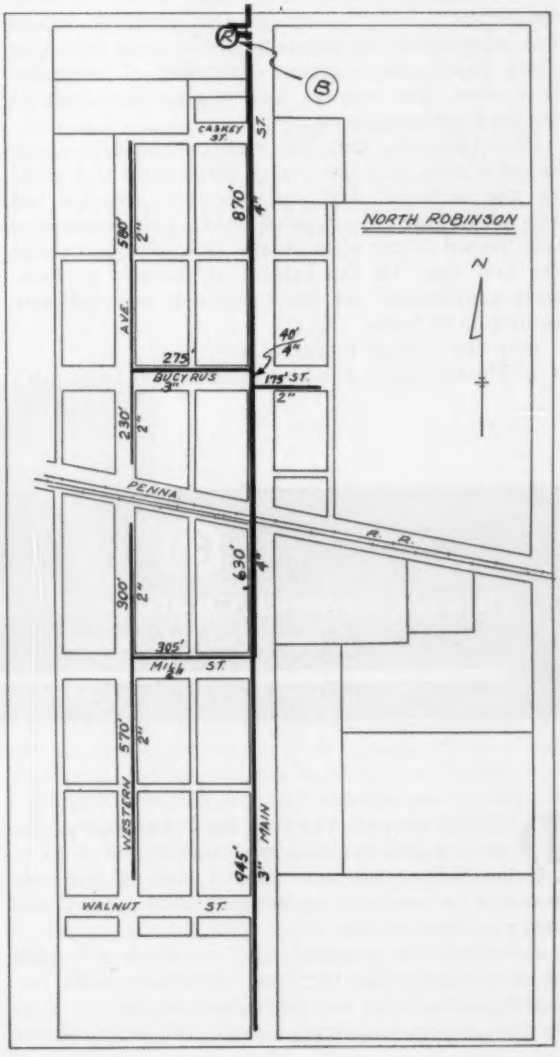
From a nearby high-pressure transmission line, a 2-in., medium-pressure steel supply line runs some 4000 ft to North Robinson, where regulation reduces the gas to the intermediate pressure at which it is to be served. The plastics pipe was used only for the intermediate pressure section which has a maximum pressure of 5 psi. A total of about 5000 ft of 2-in., 3-in., and 4-in. plastics pipe was used.

The plastic selected was ABS Type I (acrylonitrile butadiene styrene). It was chosen because of: its considerable history of satisfactory performance, its availability in AGA pipe sizes, and its wide range of available fittings.

As this was a pilot installation, a rather elaborate time study was set up. Studies of the figures established are still under way. The piping layout was conventional, according to our standards. The pipe was laid in the space between the road and the sidewalk and there were no curbs to contend with throughout most of the job. We normally use 30 in. of cover, but it was decided to use 36 in. to lessen risk of accidental puncturing during any subsequent digging in the area, and as an added protection from secondary stresses due to traffic.

The crew was a normal one for small jobs. It consisted of: one fitter in charge, one welder, two fitters, and two maintenance men.

The fitter in charge had spent a day at the manufacturer's plant where he was instructed in handling and joining plastics pipe. On the first day, manufacturer's representatives spent some time with the crew to make sure all were properly instructed in solvent-welding techniques and handling plastics pipe.



Since it weighs only about one-seventh as much as steel pipe, stringing was a minor chore. Skids were not used, eliminating another time-consuming job.

Lowering-in was performed by one or two men without mechanical aid. The rate varied from 445 ft per manhour—for 4-in. pipe—to 3020 ft per manhour. This includes installing copper locating wire, including a lead to each service curb box. The 4-in. pipe was installed first. During this phase, it was decided that it was unnecessary to tape the locator wire to the pipe. This change expedited lowering-in on later sections.

Jointing was accomplished with no difficulty after the first few joints were made. The pipe ends were checked to insure that they were square and properly entered the coupling or fitting. Then both pipe end and the inside of the fitting socket received two coats of ABS thinner, applied with a rag. The same surfaces were then coated lightly witht ABS cement. The pipe was firmly seated to the full depth of the socket and given one-eighth to one-quarter turn. All excess cement was removed with a clean rag.

Two facts were discovered early on this job. First, the pipe and fittings should be at the same temperature. Second, some trouble with the cement was experienced during one period of high humidity. Since plastic has a greater coefficient of expansion than steel, pipe storage and joining were kept in the shed, where possible.

This being the first job, each completed joint received a soap suds test before lowering-in took place on the sections. And, an overnight pressure test was performed on completed work. Leak experience was limited to two leaks on the nine joints completed the first day. On the balance of the job, no leaks were experienced and the completion test indicated no drop in 24 hours.

Our conclusions to date are:

1. **Plastic pipe** in 4-in. and smaller sizes has a price advantage over mill-coated steel pipe. On this job, it amounted to 12.8 per cent.

2. **Labor costs** are lower and more experience would widen this differential. Much of this is in the ease and speed experienced in handling the pipe itself. Solvent joining has the advantage of permitting construction without welding, placing on skids and the lining up. Checking for holidays, coating the joints and patching are also unnecessary with plastics pipe. Smaller crews can lay more plastics pipe per manhour with less fatigue than can larger crews on steel pipe.

3. **Equipment** costs would be reduced, both as to number of pieces of equipment and the size. On future jobs, the pipe's light weight will mean a reduction in the number of trucks. This, coupled with elimination of the electric welding machine, the tar kettle, and pipe handling equipment will reduce equipment costs 20 to 25 per cent.

4. **Overheads,** fringe benefits and fixed charges on equipment would be reduced by the greater productivity, lesser equipment and moving from one job to another.

5. **On the negative side,** the ease with which plastics pipe can be punctured by digging equipment is still a disadvantage for the material.

6. **And, the large coefficient** of expansion of plastic requires extreme care to be sure that secondary stresses are not built into the piping, leading to failure at lower temperature. A practice of backfilling in the morning with pipe snaked for slack in the ditch is desirable.

This pilot job will be watched very carefully. Further development work in use of plastic material will go on in Ohio Fuel Gas and other companies of the Columbia System. We do not propose to convert to all plastic for low and intermediate pressure systems, but it is comforting to know that a reasonable substitute for steel pipe is available.

PUBLIC SERVICE COMPANY OF COLORADO
DENVER 1, COLORADO

JOHN F. FUGAZZI

Distribution Maintenance Engineer

DURING the past 10 years, the Public Service Co. of Colorado has used more than 1 million ft of cellulose acetate butyrate plastics pipe for the construction of new and replacement underground natural gas service lines.

Conservatively speaking, the service performance of this material has been most satisfactory. To our knowledge, we have not experienced a single failure. In fact, recent laboratory analysis of pipe samples removed from one of our oldest active service lines revealed no sign of material deterioration.

We have experienced some problems in the use of plastics pipe over the years, but they have been relatively few in number and all attributable to the human element of construction work.

Butyrate was the material selected for experimentation and use. To date, it has been used exclusively, primarily because of its excellent service record.

Public Service Co.'s first butyrate pipe gas service, a new, direct-burial installation, was laid in March 1951. Since that time, butyrate has been used continuously for the same purpose. Its use for such service has been restricted, however, to pre-selected gas distribution areas of appreciable size wherein soil conditions are so corrosive that short steel-pipe life might be expected. The objective was two-fold: first, utilize the material on a scale sufficient to provide meaningful service performance experience data but in a way that would simplify any needed maintenance work; and second, to install the pipe in areas where the greatest potential benefit might be gained because of its corrosion resistance.

Early in 1954, after extensive company experimentation and development work, we started using butyrate to repair old defective steel pipe gas service lines by insertion. This method has been used ever since wherever and whenever operating and service conditions permitted.

More than 14,000 butyrate pipe gas service lines are now in service in the metropolitan Denver area. Of these, 7300 are direct burial and 6700 are plastic insert installations.

All of the plastics pipe gas services installed over the past decade are still active with the exception of those abandoned or replaced to meet operating needs.

The potential benefits generally associated with plastics pipe for gas distribution piping are of a long term nature. It has been our experience that very appreciable benefits may be realized immediately by the insert method. This method simplifies construction work, permits very substantial savings to be made, and provides a means to preserve and perpetuate customer good will, all as a result of the greatly diminished need for trench excavations in customer property. New service line construction practices and conditions differ to such a degree that we have gained very insignificant initial benefits through the use of plastic for direct burial.

The long term potential benefits of plastics pipe relate to pipe life. Unlike metals, plastic is considered to be chemically inert in natural soil environments. This corrosion resistance—together with the lack of evidence of other potentially destructive agents in natural gas distribution—offers sound reason to believe that long life may be realized. Much of the plastics pipe in the company's distribution systems is now of the age that such pipe life benefits are at least beginning to accrue.

In light of the experiences of the Public Service Co. of Colorado during the past 10 years, the suitability and serviceability of butyrate plastics pipe for underground natural gas distribution piping is beyond question. The material we used has performed practically trouble-free to date. There is no reason to believe that it will not continue to serve satisfactorily for some time to come. However, the preceding statements should be qualified by saying that the pipe should be of good quality and used in keeping with its physical qualifications and limitations. This point cannot be overstressed.

National interest in the use of plastic piping materials has consistently increased over the years. The publication of plastics pipe fitting standards, which are now being developed, will undoubtedly stimulate usage. In my opinion, the future of such materials looks bright and promising.

THE GAS SERVICE COMPANY

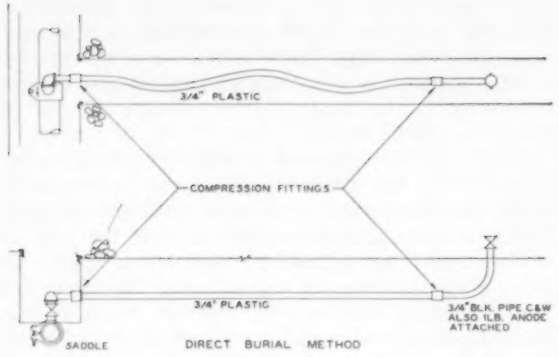
KANSAS CITY MISSOURI

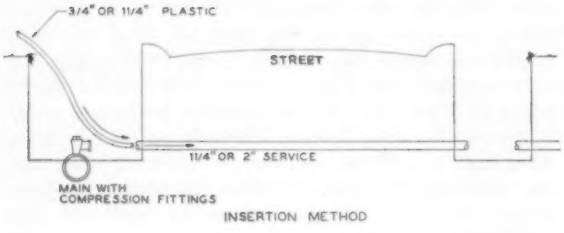
JOHN E. WRIGHT

Corrosion Engineer

GAS Service Co.'s division in Kansas City, Mo. first decided to use plastic to renew service lines in December 1952. There were two reasons. First, the cost of renewing leaking services by removing and replacing existing service pipe had become exceedingly high because of street cuts which had to be removed and replaced. Second, plastic is an inert material which can be easily slipped inside the existing service, providing a service which would undergo no future corrosion.

Various types of plastic have been used since the plastic program began; but only two types have been used extensively. The first, a cellulose acetate butyrate with a 1-in. inside diameter and a 1.14-in. outside diameter, was purchased in 20-ft sections. The second was purchased in 1956 and has been used exclusively since that time. It's polyvinyl chloride plastic with an inside diameter of 0.92 in. and an outside diameter of 1.05 in. We call this size ¾-in. We first purchased this PVC in 20-ft lengths. But since 1959, we have bought only 30-ft lengths which allow us to renew a service under a 27-ft street without solvent welds inside the old line. Since February 1960, PVC has also been purchased—again in 30-ft lengths—with an inside diameter of 1.50 in. and an outside diameter of 1.66 in. We call this size plastic 1¼-in. and use it





for renewing 2-in. services under streets.

When the plastic program was started in 1952, plastic was used exclusively for renewing services by insertion. The insertion method is used on 1¼-in. services generally carrying not more than 2 psi pressures. The method consists of digging up the service line on each side of the street at the curb. The service line is killed at the main and sections are cut out so the plastic may be inserted. A wooden plug is placed in the end of the plastic before insertion to aid in feeding the pipe through the service. The plastic is then hooked up—with compression fittings—to the service going to the customer's house (providing the pipe is not leaking) and to the main, again with compression fittings.

When butyrate was used (1952 to 1956), a thickened piece of plastic had to be solvent welded over the regular-sized tubing and a compression fitting was used over this thickened portion. Experience has shown that the rubber gasket exerted enough pressure to make the butyrate cold flow, causing some failures. Also, using alcohol to thaw out regulators and meters softened butyrate.

With PVC, a metal stiffener is placed inside the ends of the pipe before the compression couplings are used. Since we have been using PVC (1956), we have experienced no failures due to cold flow. Also, alcohol usage is allowed because it does not affect PVC.

Since September 1959, PVC has also been used for laying complete service lines from the main to within 10 ft of the meter via the direct burial method. The ¾-in. pipe is solvent welded with insert-type couplings to the required length and snaked in the ditch to the meter riser. The purpose of snaking the pipe is to provide a margin for contraction in the winter months. The meter riser for plastic services is a 10-ft piece of ¾-in. pipe bent to a gradual 90-deg. bend with pipe benders. The riser has a ¾-in. meter cock on one end and on the other, a welded-on compression coupling fits the plastic. The meter riser has a suitable pipe coating and—when installed outside a customer's house—has a 1-lb magnesium anode attached to prevent corrosion. PVC services are subjected to pressures ranging from 5 to 35 psi.

Approximately 900 services were renewed by the insertion method using the butyrate. About 19,500 in. of 1-in. pipe was used up to 1956.

Since 1956, about 2050 services have been renewed with ¾-in. PVC via insertions. Also, some 500 services were made by direct burial. Total footage of PVC used since 1956 is 106,286 ft of ¾-in. and 660 ft of 1¼-in.

The environment in which the plastic is installed includes practically every possible type of soil condition found around large cities. PVC has been laid around leaking sewers—with no failure to date. The soil resistance in Kansas City ranges from 100 ohm-cm to 40,000 ohm-cm in areas where the plastic is in use. Soil where PVC is buried ranges from moist sand to clay. To date, there have been no failures due to soil conditions. Ground temperatures in the area range from 70 deg F maximum to 20 deg F minimum.

We do not bury a wire (for locating purposes) when plastics pipe is used for complete services because they are installed at a 90-deg angle from the main to the meter and because all meters used with plastic services are set outside. When we know where the meter and main are located, we know where the service lines lies.

We find that plastics pipe has some advantages, a few of which are: it is an inert material which cuts down maintenance due to corrosion, it is easily solvent—welded together to form any length, it is easily inserted inside existing piping, it has a smooth internal wall and can pass almost as much gas as the next size larger steel pipe, and it is light-weight and easily transported.

We find that plastics pipe also has disadvantages, a few of which are: the solvent used for welding must be fresh or failure occurs at the weld, solvent welds do not hold unless a sufficient amount of solvent is used and a sufficient amount of curing time is allowed, the coefficient of contraction is so high that unless the pipe is cut sufficiently long it pulls out of the compression couplings in cold winter months (if the compression couplings hold, it pulls in two at a weld if improperly made) and last, plastics pipe will not take the abuse that steel pipe will (rocks falling on pipe during backfilling operations, etc.).

In conclusion, it can be said that we are pleased with our plastics pipe program which was guided to a certain extent by the report of the Sub-Committee on Plastic Pipe Standards, presented to the AGA Distribution Conference in Chicago in 1956.

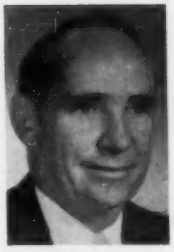
We plan to continue using plastic for renewing services and for installing new services. We do hope, however, that in the future even better materials will be developed, materials which will have a lower coefficient of contraction and expansion—as this appears to be the cause of some of our failures. ■

James Wilson
United Gas

W. L. Lee
Atlanta

Harold Lauer
MichCon

GAS·PEOPLE



J. C. Dezelle
United Gas

Howard Noyes
Columbia

JAMES A. WILSON, a vice president of the Texas distribution division in Houston since 1954, has transferred to the Shreveport general office of United Gas Corp. Wilson will be in charge of and responsible for the administration of the distribution operations of United in Texas, Louisiana, and Mississippi. J. C. DEZELLE, assistant operations manager of the Texas distribution division since 1957, is responsible for the activities in Texas that were formerly directed by Wilson. J. C. FLANAGAN, vice president of the Texas distribution division in Houston, and E. L. HENDERSON, vice president of the Louisiana-Mississippi distribution division at Shreveport, continue in their respective capacities. Wilson, currently president of the Southern Gas Association, is a 30-year veteran of the gas industry.

HAROLD R. LAUER named manager of Michigan Consolidated Gas Co.'s new business division.

LEN E. BROCK named regulator sales and service engineer in the Permian Basin area and ROBERT CHURNSIDE named sales engineer for the midwestern area of Grove Valve & Regulator Co., Oakland, Calif.

CHARLENE GARDNER joined the sales and advertising staff of Southwest Gas Corp., Las Vegas, Nev.

JOHN I. RUDGE from executive vice president to president, Carlon Products Corp., Aurora, Ohio.

W. L. LEE from executive vice president to president of Atlanta (Ga.) Gas Light Co., succeeding D. A. CRAWFORD, who has resigned.

HOWARD B. NOYES elected vice president for gas procurement, Columbia Gas System Service Corp. Noyes, headquartered in Houston, succeeds IRVING K. PECK, who has retired.

DEWEY D. BERNARD named assistant to E. E. Goodman, coal tar enamel products manager, Granite City, Ill., of Reilly Tar & Chemical Corp., Indianapolis, Ind.

D. K. DAVIS named general manager of Midwestern Manufacturing Co., Tulsa.

F. WAYNE SHARP, vice president and treasurer of American Natural Gas Co., elected secretary and put in charge of the company's New York office. He replaces DUDLEY B. W. BROWN, who has retired as vice president and secretary but continues as a director.

LEWIS C. MAULL named manager of management consulting services for the south central regional office (Dallas) of Ebasco Services Inc., New York.

MRS. JOYCE LEIST named institutional equipment advisor in the commercial sales department, Ohio Fuel Gas Co., Columbus.

C. T. CASSELL named Amherst manager, Ohio Fuel Gas Co., Columbus.

HENRY R. FLANEGAN from manager of customers service department to manager of the Philadelphia division customers service department, Philadelphia (Pa.) Electric Co.

JAMES R. MCKENZIE named sales representative in Nebraska and parts of Missouri, South Dakota, Iowa, Illinois, Indiana, Kentucky and Tennessee by Vulcan Div., Reeves Brothers Inc., New York.

JAMES CRILLY from assistant superintendent of dispatching and gas supply to superintendent of gas production, Elizabethtown Consolidated Gas Co., Elizabeth, N. J. With the promotion of Crilly, the company's gas plant enters its 69th year of management under a member of the Crilly family. His grandfather, Roger Crilly, held the job for 43 years. Following his death, the plant was managed by his son, John J. Crilly. John directed the operation from 1935 until his recent appointment as assistant vice president, operations.

ARTHUR R. DILLON from district supervisor to central division manager (Illinois, Indiana, Ohio, Pennsylvania, New Jersey, Maryland, Delaware, Kentucky and West Virginia), of Heath Survey Consultants Inc., Wellesley Hills, Mass.

ROBERT A. OLEN from president of the Four Wheel Drive Co. to vice president, Gar Wood Industries Inc., Wayne, Mich.

(*Continued on page* 120)

GAS DISTRIBUTION NEWS

GAMA reports on gas appliances

Factory shipments of gas ranges totaled 1,815,800 units in 1960. Units sales of gas central heating equipment hit the second highest level in the gas industry's history during the same year. The statistics were compiled by GAMA.

The 1960 sales of built-in gas ranges beat 1959's record-setting pace. Some 341,600 of the built-ins were sold last year.

Free-standers accounted for 1,474,000 in unit sales during the first year of the Sixties. However, this type of range trailed 1959's mark of 1,657,300 sales in the free-standing class.

In the central heating equipment field of gas appliance sales, gas-fired forced warm air and gravity type numbered 988,700 in unit sales during '60. Good old 1959 was the only year in which manufacturers sold more of this type.

Boilers, gas-fired, used for central heating systems, had sales of 141,728 units in 1960. And, conversion burners chalked up sales of 132,600 units in the same year. Other space heating statistics from the survey reflecting 1960 sales are: 366,500 vented recessed heaters; 1,183,900 room and direct heating equipment; 86,700 gas floor furnaces, and 165,800 gas unit heaters and duct furnaces.

No gas, ConEd turns to fuel oil

Shortly after the Supreme Court of the United States upheld FPC in the ConEd-Transco X-20 case (saying that the New York utility could not purchase gas for its steam-electric boilers from gas producers and have Transcontinental Gas Pipe Line Corp., transport it to New York), Consolidated Edison moved to convert nine of its low-pressure boilers to fuel-oil firing.

The New York City Air Pollution Department said this move "is not what we hoped for." The nine boilers are in ConEd's 14th street plant.

Both this plant and the one on 41st street, near the United Nations Building, have, it appears, caused considerable air pollution, in the opinion of inexpert local citizens and groups. Frankly, we doubt it as Con Edison should know pretty well how to fire boilers in their electric power plants with coal, fuel oil, or what have you, without excessive stack emissions. However, ConEd would have preferred to use natural gas, as who wouldn't.

In the case of the plant near the UN, it seems to us that firing with oil, which will produce more (than with natural gas) stack irritants, will not make a great deal of difference as long as people are permitted to take off their shoes in that organization.

Lone Star grows

AGA president L. T. Potter's statement predicting fast growth for the gas industry in 1961 is being backed up by Lone Star Gas Co., Dallas, another organization which lists Potter as its president. Lone Star and its subsidiary, Lone Star Producing Co., announced a record initial investment budget of $33.6 million for the year.

About two-thirds of the funds will go to maintain and strengthen gas service in and around the 462 cities, towns, etc., the big company serves. The Producing Co. will spend the remaining third on drilling and deepening gas wells, new leases, and gas exploration.

Potter said, "We anticipate adding approximately 26,000 new customers during 1961. . . ."

SoCounties celebrates

Southern Counties Gas Co., Los Angeles, is celebrating its Golden Anniversary in 1961. President Guy Wadsworth indicated that the best anniversary present it received was when customers passed the 750,000-mark in the final months of '60. The count showed 762,486 customers in the early part of '61.

The firm served only 3000 customers when it was founded in February 1911. SoCounties expects to add 45,000 customers in '61.

We are confident the whole gas industry joins GAS in wishing SoCounties another 50 years of growth with service and prosperity.

MidWest meets

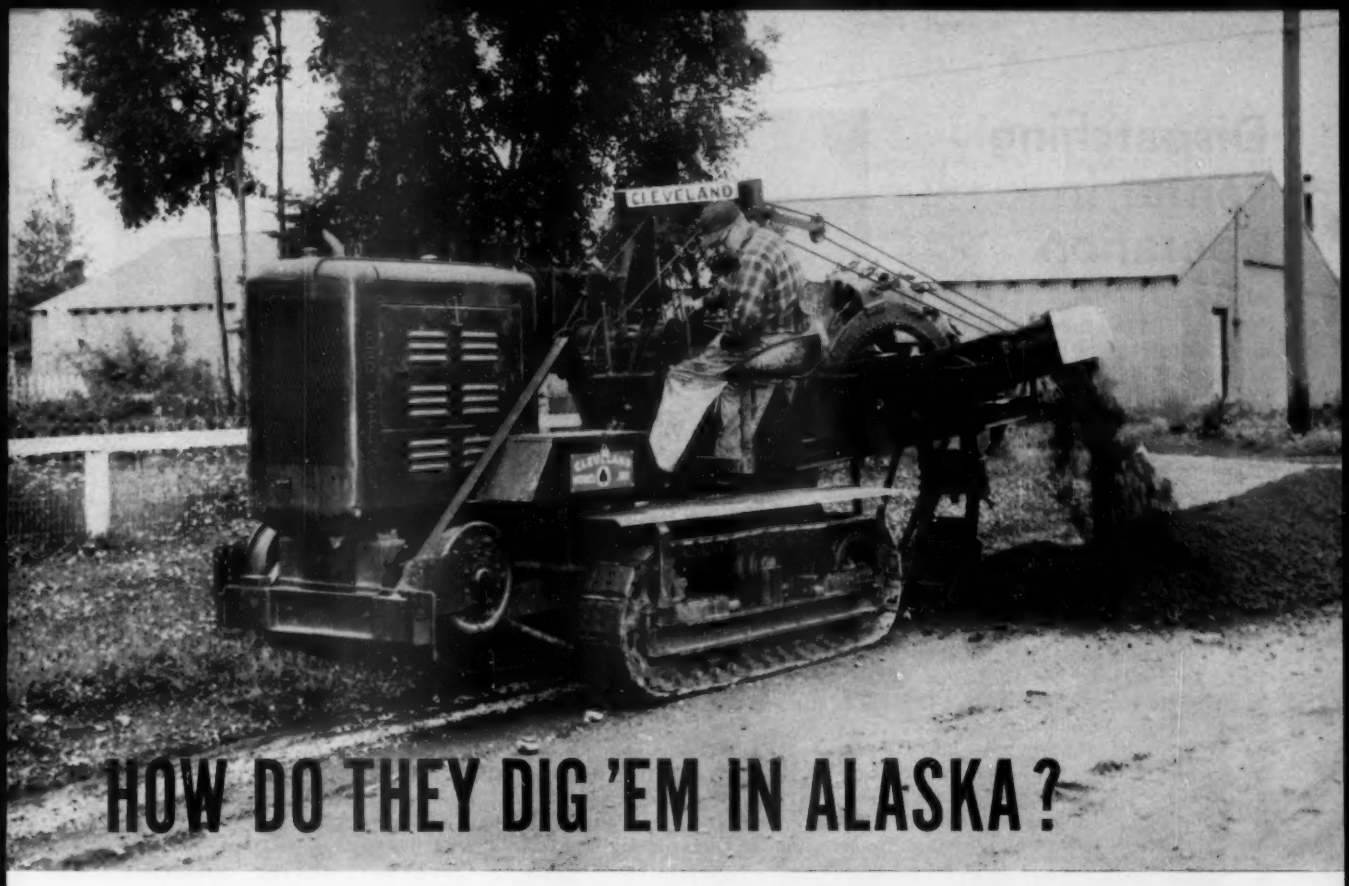
Feature gas industry convention of the month will be the 56th annual MidWest Gas Association get-together in Omaha on March 27-28. Thirteen speakers will be featured.

Some of the speakers will be William Hazlett Upson, writer and lecturer noted for his "Alexander Botts" articles; Dr. M. A. Elliott, director of IGT; Dr. George Odiorne, director of the University of Michigan's Bureau of Industrial Relations; Lester Potter, president of AGA and Lone Star Gas Co.; and Minneapolis Gas Co.'s president, Gerald Mullin.

N. J. utility plugs area development

A continuing area development program by Public Service Electric & Gas Co., Newark, was given added stimulus by the release of a new booklet titled: "New Jersey—Land of Amazing Industrial Advantages."

The new booklet takes readers on a combined aerial and ground journey through New Jersey. Descriptions of the state's many resources are presented in prose and picture detail.



HOW DO THEY DIG 'EM IN ALASKA?

With Clevelands • • • just like the rest of the U.S.A.

As natural gas spreads through Alaska, the same modern high production equipment used in the rest of the U.S.A. is speeding construction of facilities. Cheney Construction Co., for example, is using this Cleveland J-20 to cut miles of trench for the distribution system in Anchorage.

Cheney believes in employing the most modern equipment. And the J-20 is surely that. At his seat, Cheney's operator has 100% control of every J-20 operation—conveyor shifting, spoil discharge speed and direction, crawler speeds, steering, boom hoist and digging wheel speeds. In close quarters the Cleveland J-20 maneuvers quickly and easily, sneaks by trees and poles, cuts trench as close as 18 inches from side obstructions. It digs to precise grade and width requirements . . . discharges fined spoil where wanted for low-cost backfilling . . . delivers high daily production on services as well as mains.

THERE'S NOTHING LIKE THE CLEVELAND J-20 FOR DISTRIBUTION TRENCHING

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- DIGS 12" TO 24" WIDE, TO 5½' DEEP.
- 4 FORWARD WHEEL SPEEDS PLUS REVERSE.
- 33 POSITIVE, NON-SLIPPING DIGGING SPEEDS.
- ALL SPEEDS IN BOTH DIRECTIONS.
- WORLD'S FINEST TRENCHER CRAWLERS.
- 1,000-HOUR TRACK LUBRICATION.
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Dispatching center in operation

Section of Public Service Electric & Gas Co.'s new million-dollar gas dispatching center.

One of the most modern gas load dispatching centers has been placed in operation by Public Service Electric & Gas Co. in its Jersey City (N. J.) commercial office building. Several years of planning and more than $1 million went into the development of this center.

The main operations room of the dispatching center is a closed ellipse formed from 28 individual telemetering panels, totaling 138 ft in length. Operating at present are 10 of the panels, each of which is connected by a leased telephone circuit to a separate outlying natural gas metering station. With the use of tone telemetering transmitted over telephone wires, the monitoring and control of pressures and natural gas flows, in both the metering stations and remote sections of the distribution system, are controlled at the gas dispatching center.

Present total gas system capacity of Public Service is 7.75 million therms. Natural gas is available in quantities up to 540 MMcfd for this winter. Gas comes from three pipeline companies in the Southwest and three Pennsylvania storage fields.

In the dispatching center, two or more dispatchers are on duty at all times. They are responsible for scheduling the gas manufactured in the company's six gas production plants and for allocating and controlling the delivery of natural gas at more than 30 meter stations in the distribution system and six meter stations serving the electric department's generating stations. The dispatchers are seated at two specially designed consoles, 26 ft long, which are shaped to conform to the ends of the elliptical room. This allows the men to face the panels in each quadrant of the room.

Former procedures required field personnel to visit each outlying gas metering station several times each day, telephone in pressures and other data required to calculate gas flow, and to manually make necessary pressure adjustments. By using the present tone telemetering system, practically all of this field work has been eliminated with control centered at the dispatching headquarters.

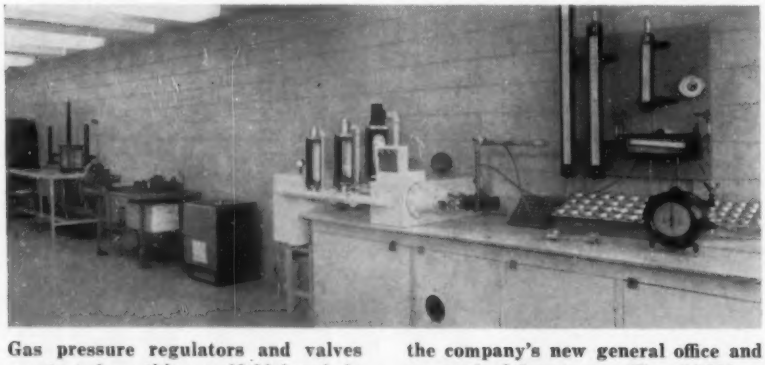
The dispatching center is equipped with two teletype weather machines, one from the weather bureau in New York and the other from a private forecaster in Boston.

NI-Gas orders computer

Northern Illinois Gas Co. has ordered an H-800 computer from Minneapolis - Honeywell Regulator Co. The system will be delivered early in 1963, coinciding with completion of the company's new general office building near Aurora, Ill.

First use of the computer will provide more efficient billing and accounting for the customer list. It also will improve accounting methods for plant investments, payroll and other accounting applications, including maintenance of the files of some 110,000 stockholders.

W. J. Crowley, vice president and comptroller of NI-Gas, said the computer also has sufficient capacity to assist in solving engineering, economic and research problems.



Gas pressure regulators and valves are tested on this manifold bench in Maxitrol Co.'s new mechanical control lab. Three remote-controlled compressors, located in another wing, deliver up to 20 psi flow rates of 25 mcfh to this bench. It's part of the company's new general office and research laboratory. The 24,000-sq ft facility is in Southfield, a Detroit suburb. Featured in the new structure is the "heating laboratory" with its own gas-fueled heating and air conditioning plant.

PG&E's weather bureau receives top honor

Pacific Gas & Electric Co.'s weather bureau has won the American Meteorological Society's top citation to a corporation. The San Francisco-based company was honored for its "perception, imagination and leadership" in maintaining its own weather service.

PG&E's weather service was established in 1937 to predict customer demand for natural gas. Five full time meteorologists are now employed by the company.

A "first" for the gas industry was scored when John E. Heyke (2nd from right) turned $100,000 check over to J. Anthony Panuch, vice president of the 1964-65 New York World's Fair. The check covered half of the first year's rental on the gas industry's exhibit site and was the first to be received by the fair corporation. Heyke is president of Brooklyn Union Gas Co. and also heads Gas Inc., industry-formed corporation to operate the gas exhibit. Shown with Heyke and Panuch are (at left) Thomas J. Shanley, liaison officer between AGA and Gas Inc., and Stanley B. Finch, executive secretary of Gas Inc.

Digs second storage cavern

Cincinnati (Ohio) Gas & Electric Co. is developing its second underground storage project in its southwestern Ohio-northern Kentucky service area.

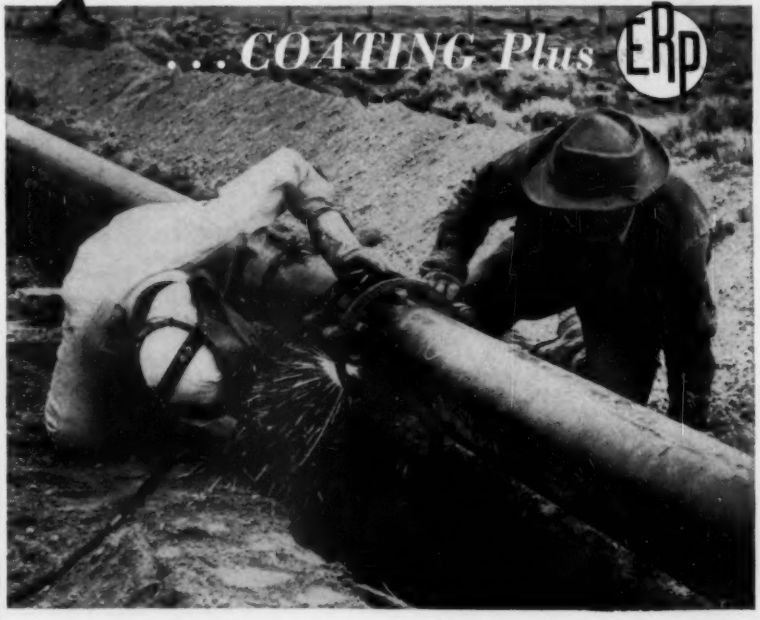
The $1 million liquid propane storage cavern is 5 miles west of Covington, Ky., just south of the Ohio River.

A $2-million gas processing plant, south of the cavern near Erlanger, Ky., will be connected to the cavern by an 8-in. pipeline.

Cincinnati Gas installed its first underground storage cavern and processing plant near Middleton, Ohio, in January 1959. The two plants will be able to boost the area's gas supply by as much as 100 MMcfd—each operation producing 50 MMcf.

William J. Schreiner, CG&E project representative, points out the main shaft to sponsoring engineer Henry R. Meyers (left).

Rx FOR SURE PROTECTION



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AGA, GAMA to get census study

AGA and GAMA are charter members of a group called the Association Council on Housing and Population Census, for which 1960 Census cross-tabulations are being prepared.

Developing the data is the data processing center division of S. J. Tesauro & Co., Detroit. Release of the information by states, counties, and "standard metropolitan statistical areas" is to start this spring. It will be completed by the end of the year.

In September 1960, the council contracted with Tesauro to do the programming, data processing and publication of the huge statistical venture, which will chart new data fields for appliances, automotive, home building, and other vital industries.

Tapes containing individual replies to the detailed questions on population and housing characteristics of over 2.5 million households will be processed at the Bureau of the Census. These non-disclosure tapes will be further processed by Tesauro, starting this spring. Published tabulations will be in the form of two parameter cross-tabulations of 41 important characteristics for every county, standard metropolitan area, state, and the U. S. as a whole.

High-speed processing will permit publication of the first state volumes by June. They're expected to be completed by the fall.

Factors covered in the 2.5 million questioned households include 11 key population characteristics and 18 key housing characteristics completely defining the character, value and age of homes.

A complete set of volumes will contain over 16,000 pages. In addition to the printed volumes, data will be made available on IBM and Remington Rand magnetic tape or in 80- or 90-column punch card form.

Mich Con boosts state

Michigan Consolidated Gas Co., Detroit, has stepped up its promotion of its home state as an industrial location.

First move in the greater effort, according to Hugh Daly, executive vice president, was to put into national circulation a brochure promoting Ann Arbor's Industrial Research Park.

Potter asks for impartial study

The gas industry assured President Kennedy of its "fullest cooperation" in any impartial study of the nation's energy resources conducted by "qualified people."

In a letter to the President, AGA president Lester T. Potter said "we dedicate our industry's full resources in support of any objective study of the fuels.

"The record will show that, over the years, our industry has cooperated fully in other studies of our energy resources and policies by Congressional or other governmental agencies."

Potter's letter referred to the proposed Congressional study on the necessity and desirability of establishing a new overall "National Fuels Policy."

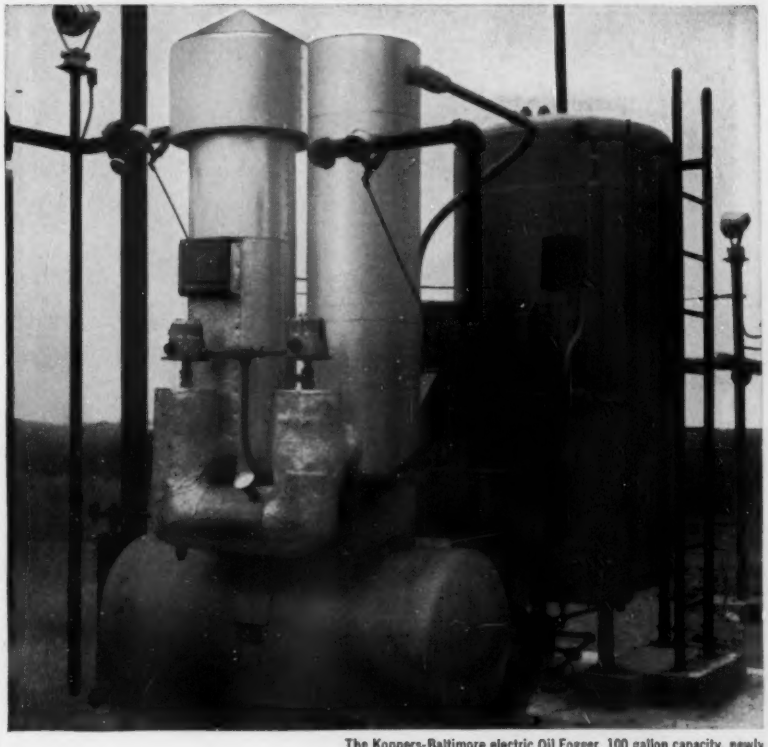
"Since the gas industry supplies 28 per cent of the energy needs of the nation," the letter said, "we are vitally concerned that an abundant supply of low-cost fuel continues to be available to further America's growth and security."

While pledging gas industry cooperation in the study, Potter expressed the industry's concern over the study's current sponsorship by coal interests and their allies.

"There is considerable evidence to show that this group, under the guise of conservation, is aiming to undermine the consumers' traditional freedom of choice of fuel, and to ultimately assure a competitive advantage for coal by enlisting the compulsive power of government.

"We believe the public interest is best served by a policy which guarantees free choice of fuels by all consumers, and free competition among all producers and marketers. Certain it is, we believe, that the progress of our nation, under such a policy, has demonstrated its wisdom."

FOG TO PROTECT GAS DISTRIBUTION SYSTEMS



The Koppers-Baltimore electric Oil Fogger, 100 gallon capacity, newly installed at the East Rutherford Natural Gas Metering and Regulating station—the Public Service Electric and Gas Company, Newark, N. J.

FOG TO REDUCE "UNACCOUNTED FOR"

The Koppers-Baltimore Oil Fogger produces a very fine oil mist, which when introduced into gas mains, helps condition main joints, minimizes gas leakage, controls dust problems and reduces equipment maintenance.

New design principles permit treatment of several sections of a distribution system by a single oil fogger, even though each section operates at a different pressure.

The Koppers-Baltimore Oil Fogger is the only hot fogger that virtually eliminates stoppages due to carbonizing and oil sludge.

Koppers has been providing equipment for the gas industry for more than 80 years. Find out how this broad experience can benefit you . . . write today to: KOPPERS COMPANY, INC., Gas Apparatus Department, 2003 Scott Street, Baltimore 3, Maryland.

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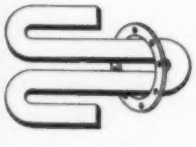
Central gaskets—ring or full face are available in 1/8" phenolic, neoprene faced phenolic or J-M style #71 dielectric material. Oval ring joint gaskets are of reinforced phenolic.

• *Designed for use with ASA rated flanges.*



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Box 762, Shawnee, Oklahoma

Gas turbines school-bound?

A revolutionary plan for producing low-cost energy from natural gas in modern schools may prove to be a $2-billion bonanza for the nation's taxpayers.

This whopping tax savings can be realized, according to AGA, by installing natural gas turbines in new compact-type schools built to accommodate increased secondary school enrollment during the coming decade.

A Houston engineering and architectural firm, Golemon & Rolfe, has just completed a gas industry research study. It reports that a 2300-student air-conditioned compact school with natural gas as its only source of energy can be built for some $2.3 million—about 16 per cent less than the present conventional type of the same size without air conditioning.

The U. S. Office of Education predicts that secondary school enrollment will increase by some 8.5 million in the next decade, calling for an estimated $9.5 billion investment in schools.

A 16-per cent cost reduction under the new plan adds up to $1.5 billion. Lower first costs in construction will save $45 million in insurance and $32 million in reduced interest on bonded indebtedness.

From the standpoint of maintenance and operation, an estimated $670 million can be saved with gas-powered schools.

D. Dana Price, chief engineer for Golemon & Rolfe, listed some advantages of the gas turbine to meet all energy requirements of the modern school:

1. It drives an electrical generator to provide high frequency power for better lighting and 60-cycle power for motors and convenience outlets.

2. Its exhaust heat can be saved, running it through a waste heat boiler to make steam or heat water. The steam can be used to run an absorption air conditioning system, to heat water for showers and kitchens, and for steam cooking.

3. It provides direct heating for various purposes.

The all-gas air-conditioned school of compact design is estimated to cost $468,000 less to build than the conventional non-air-conditioned school—and $6362 a year less to operate, the report points out.

Electronic ignition system introduced

Electronic circuitry has led Delco-Remy division of General Motors to the development of a "breakerless" ignition system. The engineering advancement was introduced at the Society of Automotive Engineers' convention in Detroit.

Chief Engineer Herman L. Hartzell says the new ignition system eliminates contact points and condensers. It also is being studied for adaptation to heavy-duty applications such as stationary engines, trucks, and tractors. In these applications the necessity of continuous operation and the elimination of maintenance downtime warrants the additional cost of the electronic ignition system, Hartzell pointed out.

Elimination of contact points and the condenser of the conventional ignition distributor is accomplished through use of a pulse-controlled transistorized unit developed by Delco-Remy's advanced engineering research staff.

One of the electronic system's first test applications has been running 5000 hours, is still operating, and is not in need of ignition maintenance.

Massachusetts builder receives gas award

The gas industry's Blue Star Home Builder of the Year Award for 1960 went to Emil A. Hanslin, builder-realtor of Lynnfield, Mass. AGA's managing director C. S. Stackpole made the presentation at the National Association of Home Builders convention in Chicago in February.

N. J. Natural builds new division office

New Jersey Natural Gas Co. is building a new office and showroom for its southern division in Wildwood, N. J.

Estimated to cost over $50,000, the building will be of modern design with the front of brick and glass. The remainder of the exterior will be stucco covered. The 117-ft x 35-ft structure will house commercial offices and a showroom for gas appliances. Gas lights will be placed around the building and the first gas-lighted sign in Cape May county will be erected on the exterior.

FOR WANT OF A NAIL

"For want of a nail a shoe was lost, for want of a shoe a horse was lost, for want of a horse a soldier was lost, for want of a soldier a battle was lost, for want of a battle a kingdom was lost—and all for want of a nail."

Mounting unaccounted-for, like the lost nail, can play havoc with the success of a company. Southern Cross Foresters in featuring "Contract Leakage Control Service" makes possible extremely close leakage control, both survey and repair, at realistic savings for gas distribution systems. On a contract basis we deliver fully-trained help when you need it... as you need it... without costly build-up of personnel and equipment. Call us collect for complete information.

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SOMERVILLE CONSTRUCTION COMPANY
ADA, MICHIGAN

Municipal system grabs LPG users

Alabama's latest government-owned gas system, the Clarke-Mobile Counties Gas District, is going to cost an estimated $3.8 million. Forty-year, 5½ per cent revenue bonds have been issued to cover construction.

At FPC hearings, the Clarke-Mobile financial witness maintained that debt service coverage by operating revenues will be approximately 2.28. However, it appears that the exceptionally long bond maturity term of 40 years is required to achieve this coverage. A *pro-forma* estimate of coverage provided by a 30-year bond issue showed a coverage of only 1.59.

Financing for the new gas utility district is based upon market and feasibility studies made by J. B. Converse & Co., Mobile. These indicated that most of the district's domestic customers will come from the ranks of former L.P. gas users. Estimates submitted by the district claimed natural gas rates would be lower than butane prices prevailing in the area. To induce LPG users to switch, free conversions will be offered. A $200,000 fund is supposed to be set aside to take care of the first 2500 customers. However, market studies showed the conversion potential as 2000 customers.

The district expects to balance its load by connecting industrial customers.

Lone Star Gas Co.'s Fort Worth division has installed 75 Gaslites on three levels of its building. The lighting started as a Christmas decoration, but Lone Star made the installation permanent. Just a small portion of the lighting is shown here.

GAS • News Notes

Northern Illinois Gas Co. has started construction on its new maintenance and construction center in Crestwood, Ill. The $100,000-building will provide 7400 sq ft of space as a reporting location for maintenance and construction crews serving a 200-sq-mile suburban area southwest of Chicago.

Northern Illinois Gas Co. made a record gain of 43,559 customers in 1960. The previous high was in 1959 when 43,298 new customers were added. NI-Gas served about 716,000 customers at year's end.

C. E. Wilson Construction Co., Kansas City, Mo. has recently completed gas distribution systems in several Wisconsin towns for Milwaukee Gas Light Co. The projects, started in September, involved 40,000 ft of services, and 145,000 ft of 2-in., 12,000 ft of 3-in., 15,000 ft of 4-in., and 4000 ft of 6-in. mains.

Underwriters' Laboratories has approved all of the 6400 Series Gask-O-Seals for AGA flange gaskets, according to Parker Seal Co.

Republic Creosoting Co., Indianapolis, has merged with its wholly owned subsidiaries, Reilly Tar & Chemical Corp. and Char Products Co. The merged company is known as Reilly Tar & Chemical Corp.

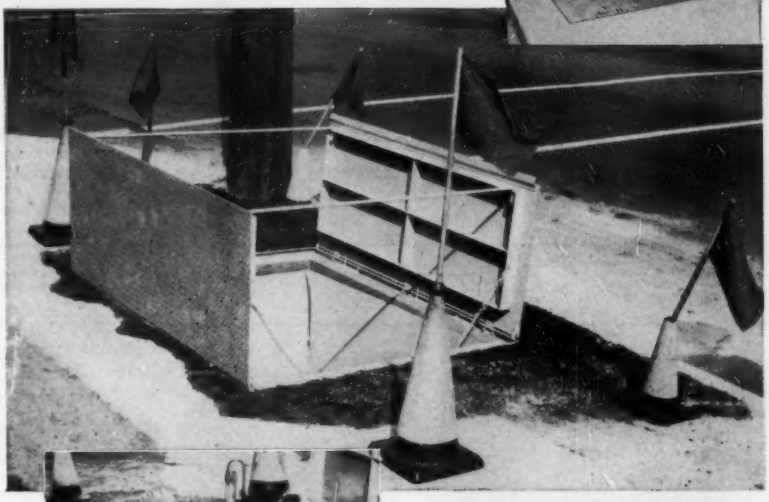
Gaffers & Sattler, Los Angeles, has named Robert M. Garrick, Public Relations Counsel, to direct public relations activities. Don Wright, former managing editor of GAS, is account executive.

Two manufacturers of plastic products for industrial applications have been combined into one organization — the Kraloy-Chemtrol Co. Kraloy Plastics Pipe Co. makes plastic pipe, conduit and fittings; Chemtrol produces plastic valves and pumps.

Modern Home Products, Russell, Ill., has changed its name to Charmglow Products.

Dresser Industries Inc., Houston, and Reed Roller Bit Co., have agreed on a plan whereby Dresser will acquire the business and assets of Reed.

easiest access to regulators under-the-sidewalk



SPRING-BALANCED BILCO DOORS ARE EASY-TO-OPEN AND COMPLETELY WEATHERTIGHT

Bilco vault doors are the safe choice for gas regulator vaults underfoot. More and more gas companies are finding that Bilco doors wear better, keep water out. When opened they provide maximum ventilation for service men's safety. Built-in drainage and easy maintenance add up to another Bilco bonus—and every Bilco door swings open easily because it's *spring-balanced!*

Send coupon today for FREE copy of article in Gas Magazine, entitled: "Standardization and Prefabrication of District Regulator Installations."

Bilco®

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The Bilco Company, Dept. A-193
New Haven 5, Conn.
Send reprint of article in Gas Magazine ( )
Send catalog with details of Bilco sidewalk doors ( )
Name_____
Firm_____
Address_____
City_____ Zone___ State_____

GAS DIGEST

New Products and Trade Literature

For more data on any of these items use the Readers' Service Card on pages 115, 116

PLASTICS PIPE AND CORROSION PREVENTION

1. Protective coating

Roskote Line Travel Mastic and Royston Insultape served as protective coating on a recent pipeline construction job (GEC-130). One regular dope kettle was used, resulting in fewer men, no fuel costs since Roskote is applied cold, and no waste due to freezeup or coking. Roskote went on at 825 gal. per mile; Royston Insultape, 480 squares per mile.
Royston Laboratories

2. Corrosion control

A data file on corrosion control of pipe has been assembled by Chase & Sons' Corr-Prev division (GEC-130). The 4-page folder (HCG-7369) is a guide to solving corrosion problems. Five products, including Chasekote and Chasewrap, are described. Chasekote is a pressure-sensitive polyethylene tape. Chasewrap is a tough sheet material which adds shielding protection to Chasekote during backfill and soil stress periods.
Chase & Sons Inc.

3. PVC pipe

Plastex Co. is offering its Schedule 40 PVC rigid plastics pipe in 20-ft lengths, either with plain ends or with coupling on one end (GEC-630). The company also has available a complete line of fittings in nominal sizes ranging from ½- to 4-in. diameter. The pipe and fittings are designed for fast and simple solvent-weld joining.
Plastex Co.

4. Pipe coating

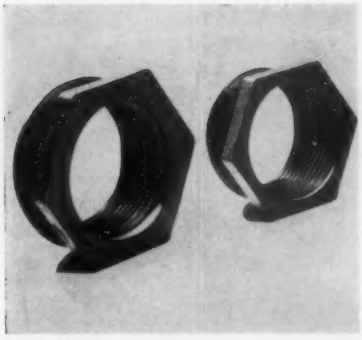
Hill Hubbell X-Tru-Coat is an extruded plastic jacket bonded to pipe with a specially developed adhesive that remains "alive" for bending and flexing during installation (GEC-620). Initially, it will be produced in sizes from ¾-in. nom. to 5 9/16-in. OD. Equipment changeover for production of the coating under the Dekoron process will begin shortly. Literature describing this and other coatings is available.
Hill Hubbell Co.

5. Pipe tape

Arno Adhesive is producing an improved version of its C-350 polyethylene Pipewrap tape used to protect pipe, etc., from corrosion (GEC-130). The tape's adhesion has been increased to 40 oz per inch width, and its tensile strength to 20 lb per inch width. The moisture vapor transmission rate has been reduced to 18 grams per 100 in. in 24 hours.
Arno Adhesive Tapes

6. Corrosion

Some "Questions and Answers About Corrosion" are contained in a new pamphlet from Reynolds Metals Co. (GEC-620). Types of corrosion covered include galvanic, poultice, and stress. Specifically, the booklet discusses aluminum and its corrosion resistant characteristics.
Reynolds Metals Co.

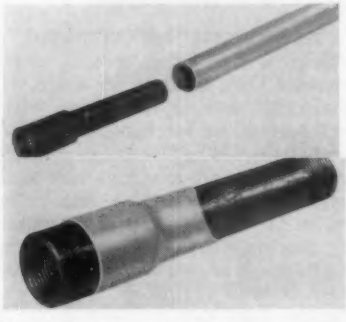


7. Insulated bushings

A new line of fiberglass reinforced nylon bushings has been designed by Central Plastics for use in cathodic protection systems (GEC-110). They are available in sizes from ½ in. through 2 in. According to the company, temperature changes and moisture pick-up pose no problem to operational efficiency. Excellent resistance to cold flow is claimed.
Central Plastics Co.

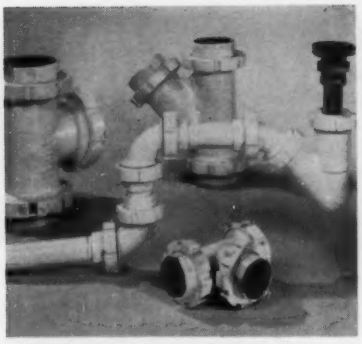
8. Plastics pipe

Glamorgan Pipe & Foundry Co. has technical data on its newest product—GP Marlex engineered gas pipe (GEC-630). This pipe is produced from a high density linear polyethylene resin manufactured by Phillips Chemical Co. It is produced in sizes from ½ in. through 4 in. and is designed for low and medium pressure applications.
Glamorgan Pipe & Foundry



9. Corrosion protection

Trans-Plastics Corp. has introduced "T-P Shrink-Tube," a polyvinyl chloride tubing that shrinks to contours of pipe, fittings, etc., and provides corrosion-resistant protection to above and below ground ferrous structures (GEC-130). The shrinkable material has a temperature service range of −8 deg to 158 deg F.
Trans-Plastics Corp.



10. Saran-lined pipe

Saran-lined pipe and simplified fittings of ductile iron are featured in a new non-corrosive drain line system from Dow Chemical (GEC-060). Dow said the fittings are designed for ease of installation and service. Union-type fittings are used with round connector nuts that can be tightened with a spanner wrench. Pipe sizes range from 1½ to 6 in.
Dow Chemical Co.

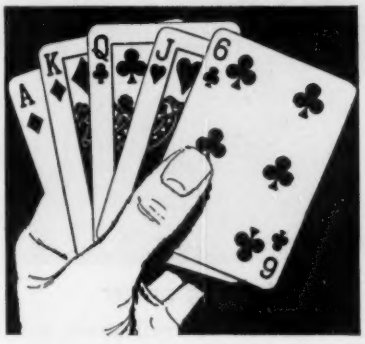
11. Maintenance coating

"Maintz" is West Chester Chemical Co.'s new protective coating which is highly resistant to corrosion and weathering conditions (GEC-130). The tough, resilient coating is said to have exceptional resistance to abrasion, weathering, and chemical corrosion. Maintz is based on DuPont's Hypalon synthetic rubber in combination with silicone and other resins.
West Chester Chemical Co.

12. Weld service taps

The Thermotap process is an economical and practical means of tapping a steel main when using plastic services (GEC-370). Available in ¼- through 1¼-in. sizes, Thermotap requires no external source of power. It is a thermite weld process that, according to Continental Industries, can never be loosened by vibration.
Continental Industries

POKER? Play to win!



How would you play this hand?

Don't let the high cards tempt you. This is no better than drawing to an inside straight (odds about 12 to 1 against filling). Fold...fast...and patiently wait for a good hand.

Here's a sure winner from FORD:

Ford pays half your fuel bills for a full six months (or 400 tractor hours) on the purchase of any new Ford or Fordson diesel tractor.

This offer, made possible by the amazing fuel-saving performance of these low-priced diesel tractors, expires March 31, 1961.

No "hidden" price increase... no tricks of any kind. See your Ford Tractor Dealer for all the money-saving details!

Tractor and Implement Division, Ford Motor Company, Birmingham, Michigan

Ford
TRACTORS
EQUIPMENT

GAS DIGEST

13. Fast-drying primer

In its first over-the-ditch pipeline application, a fast-drying primer was credited with saving time and manpower (GEC-130). Under the conditions encountered on the job, Koppers' Bitumastic Jet-Set dried in a matter of minutes. This made it possible to run cleaning - priming and coating-wrapping virtually together.
Koppers Co., Inc.

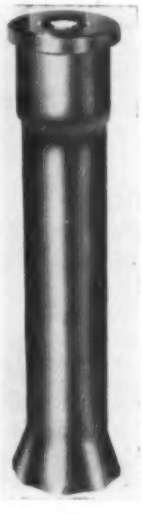
14. Pipe protection

Asbestos pipeline felt, glass outer wrap, glass pipe wrap, and pipeline padding are described in Philip Carey's newly revised literature (GEC-130). Specifications and descriptions are included in the 4-page catalog.
Philip Carey Manufacturing Co.

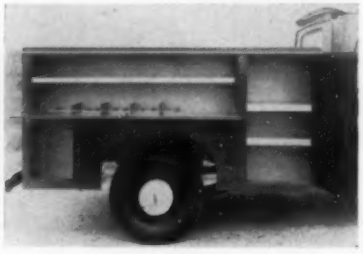
15. Coated pipe

Recent entry into the plastic coated pipe field is Standard Pipeprotection (GEC-130). Initially, the company, using X-Tru-Coat in its process, will handle pipe up to 4-in. in diameter.
Standard Pipeprotection Inc.

16. Terminal box

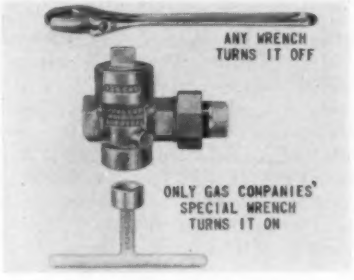


Handley's plastic cathodic terminal box was designed for flush-to-ground installation (GEC-110). Permanent magnet built into top of box and aluminum plate assure fast reaction on either magnetic or electronic finders. Entire cap is easily lifted and tilted for testing, yet is tamper-free because pentagon wrench is required for removal.
Handley Industries



17. Service bodies

A complete new line of general service bodies, conversion kits, and side boxes for use on ½-, ¾-, and 1-ton pickup truck chassis has been introduced (GEC-790). Highway's general service body line is designed for universal application in utility construction and maintenance. Available for all popular makes of trucks, including those with dual rear tires.
Highway Trailer Industries

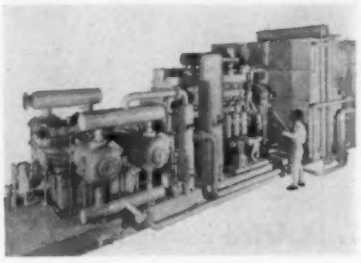


18. Gas meter stop

Mueller has added the "Innerlock" gas meter stop to its line of LubOseal meter stops (GEC-560). Innerlock provides positive control of home service turn-ons. It is constructed so that a customer can quickly and easily turn the stop off with most common household tools. But, to turn it on, the customer must call the gas company because a special wrench is needed.
Mueller Co.

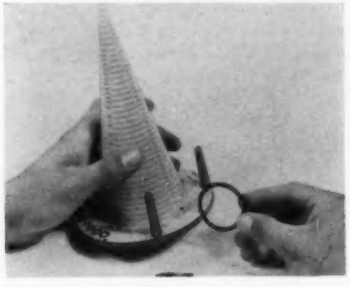
19. Motor control center

Nelson Electric's motor control center is designed specifically for use with automation systems (GEC-750). Among features are swing-out starters and circuit breakers using permanent wiring for both load and control. This means quick, easy replacement of units requiring maintenance.
Nelson Electric Mfg. Co.



20. Engines, compressors

White Diesel is producing a line of medium speed, balanced opposed compressors for gas gathering, lifting, repressuring, and booster service (GEC-160). The two-cylinder (W-62) and four-cylinder (W-64) compressors were designed for continuous, unattended, heavy-duty service and have been engineered for direct drive with White Superior natural gas engines.
White Diesel Engine Div.



21. O-ring size gauge

Parker Seal has developed a visual O-ring size gauge which enables O-ring users to check ID and cross section of O-rings without manual or mechanical measuring (GEC-540). The gauge consists of a single unit cone and base with adjustable cross section measuring strip. ID of the ring is measured by placing the O-ring on the cone, while the cross section is measured with slots in the base.
Parker Seal Co.

22. Air markers

A new line of air markers for gas pipelines has been developed by Handley (GEC-520). Both posts and signs are made of rubber-resin compound. The new markers have holders for numeral signs on which each digit occupies a rectangle of 12 x 16 in., easily located and read from the air.
Handley Industries Inc.

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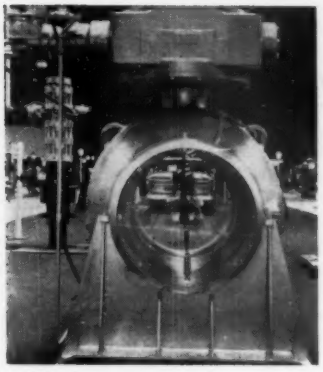
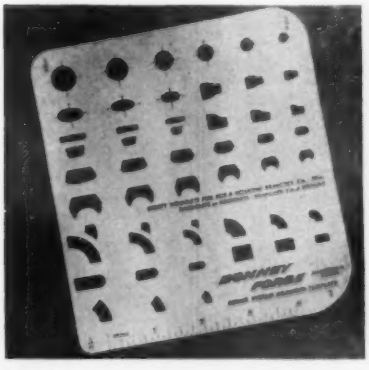


23. Valve line

Rockwell's expanded line of full round-opening Hypresphere lubricated plug valves provides a complete range of sizes for gas, crude oil and product pipeline use (GEC-820). The compact, quarterturn valve is designed for conditions requiring a full-opening, round-bore valve.
Rockwell Manufacturing Co.

24. Improved glycol

Union Carbide has introduced an improved standard grade of diethylene glycol (GEC-670). For use as a solvent in natural gas dehydration, the new grade features narrower distillation range, more precise water-content control, and reduced acidity.
Union Carbide Chemicals Co.

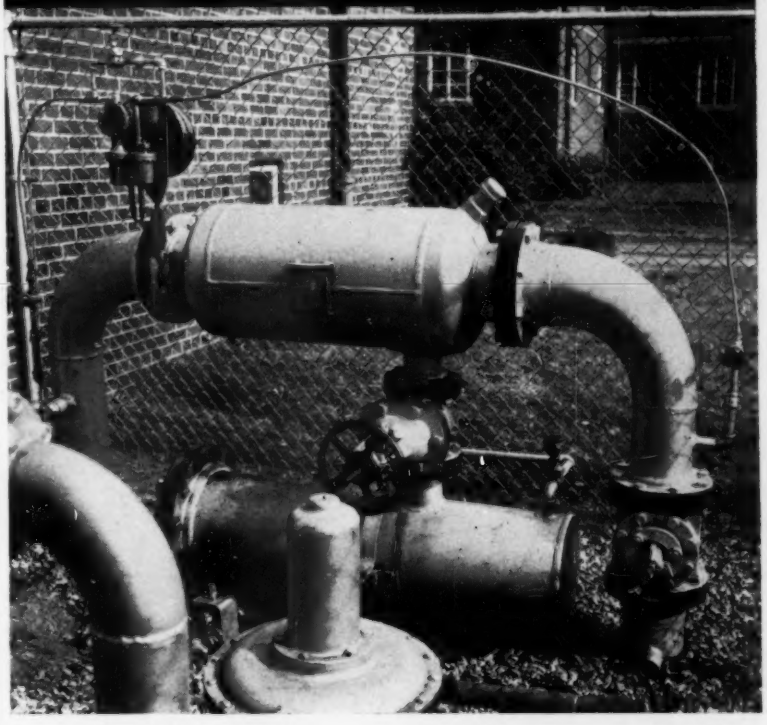


25. Piping system

A new piping system welding fitting template has been introduced by Bonney Forge (GEC-600). Including the most commonly used welding fitting shapes, the new template was prepared in cooperation with, and for, piping designers to speed design and drawing time on welded piping systems.
Bonney Forge & Tool Works

Problem:

Remove DUST from 6" Crossover Line Between Two Large Feeder Mains



Solution:

HI-EF GAS LINE SCRUBBER—To protect three American 500-B Meters serving a large residential project, a TYPE LDS-8-LP Hi-eF Gas Line Scrubber was installed in a 6" Crossover Line between two feeder mains.

Results:

Handling 20,000 to 200,000 SCFH of natural gas at 18 to 20 PSIG, this purifier, with no moving parts or screens, removed from 1 to 70 quarts of dust per day depending on flow conditions. Meter maintenance, weekly dismantling and cleaning, due to dust accumulation has been eliminated.

More Information:

Specifications on 7 types of scrubbers, purifiers, separators and mist extractors are available in Bulletin 601. Write for free copy or ask for an Anderson Engineer to call.

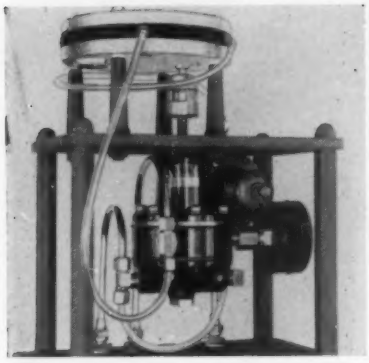
Hi-eF PURIFIER

By the Manufacturers of Super-Silvertop Steam Traps

THE V.D. ANDERSON COMPANY

Division of International Basic Economy Corporation

1981 West 96th Street Cleveland 2, Ohio



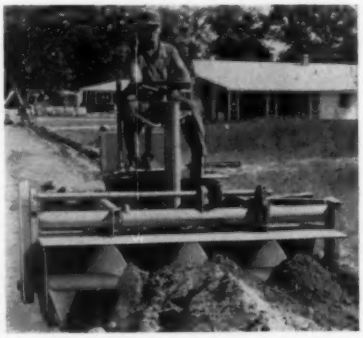
26. Gas sampler

ARCCO's Model G continuous gas sampler is for accurate determination of chemical and physical properties of a gas (GEC-670). Over a 7-day period, the sampler will accumulate at a constant rate a gas sample to a final pressure at or near 300 psig from the sample source—whose minimum pressure is not less than 340 psig.
ARCCO Instrument Co.

27. Gas burner

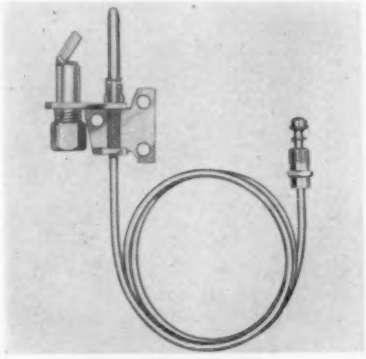
The "building block" principle of component design is used in a new line of automatic motorized, mechanical-draft gas burners from Mettler (GEC-080). The Custom Fan-Air burners feature a selection of six burner sizes in 15 burner assembly variations, providing capacities to 35 million Btu per hr. Variations available permit burner selection to meet FM, FIA, and other code requirements.
Mettler Co. Inc.

complete Lancaster
main movement
assembly
FASTER
INSTALLATION
LONGER LIFE
IN METER
GREATER METER
ACCURACY
Every quality part in this improved Lancaster Complete Main Movement Assembly with new hex is designed to make it easier to install for proper centering and easier adjustment for correct balanced stroke. Saves time . . . assures real accuracy . . . keeps meters in service longer. Upper and Lower Main Movements, Valve Cranks are available separately—or order entire Assembly ready to install.
* New Hex Speeds Tightening
For 1-A
and #240
Gas Meters
IMPROVED Lancaster COMPLETE
INDEX DRIVE ASSEMBLY
New hex saves time and trouble in installing. Adjustable worm axle dog simplifies correct positioning. Quality made for lifetime service once it is installed.
Lancaster
METER PARTS CO.
Manufacturers of Quality Parts for Gas Meters
POST OFFICE BOX 378, LANCASTER, OHIO



28. Backfiller

Vermeer's new Pow - R - Ditch Filler is designed specifically for fast, low-cost backfilling (GEC-210). It deposits dirt back in the ditch in one pass, resulting in considerable saving in both time and labor. The front-mounted, 24-in. auger leaves adjacent areas clear of all debris and dirt.
Vermeer Manufacturing Co.



29. Water heater pilot

Grayson's new CinTarg water heater pilot is said to provide superior flame stability and excellent non-linting characteristics (GEC-190). The newly designed pilot is believed to assure trouble - free performance by combining the best features of incinerator and target-type pilots.
Grayson Controls Div.

TRADE LITERATURE

30. Gas odorants

Oronite's 24-page technical bulletin contains the latest data on gas odorants and their application (GEC-590). A section on odorization covers odorizers, storage and transfer of odorants, control of nuisance odors, soil absorption, and methods and equipment used in checking odor intensity.
Oronite Division

31. Liquefied gas storage

Fantastically cold storage of liquefied gases in specially designed and constructed cryogenic tanks is described in a new brochure from Chicago Bridge & Iron (GEC-740).
Chicago Bridge & Iron Co.

32. Built-in range

A 6-page folder describes the Caloric Ultramatic built - in gas ranges (GEC-240). The full-color folder gives complete specifications on the top-burner and built-in oven-broiler units.
Caloric Appliance Corp.

33. Digital computer

Several automatic programming systems for the Bendix G-15 digital computer are described in an 8-page bulletin (GEC-180). Bulletin AR-1060 covers general characteristics of the systems for both commercial and scientific computer applications.
Bendix Computer Division

34. Cleaner-snubber unit

Burgess-Manning has published a 6-page bulletin on its type SDF combination cleaner - snubber (GEC-720). The unit is designed to be used in place of separate air intake filters and silencers for reciprocating compressors, positive-displacement blowers, and naturally aspirated or positively scavenged gas or diesel engines.
Burgess Manning Co.

35. Strip, circular charts

A new catalog tells how Honeywell charts and inks are made (GEC-750). Partial lists of commonly used ElectroniK strip and circular charts, and pneumatic and electric Tel-O-Set charts, are included in Catalog G-100-6.
Minneapolis-Honeywell

If this Housing ever Breaks or Distorts we will replace it Free
RIDGID
HEAVY DUTY
Skilled Hands Know the Difference...
Genuine
RIDGID
At Your Supply House!
The Ridge Tool Company, Elyria, Ohio, U.S.A.

people • *Continued*

from page 101

Newly elected officers at San Diego (Calif.) Gas & Electric Co. include H. A. NOBLE, senior vice president; C. P. DEJONGE, vice president, distribution; J. F. SINNOTT, vice president, engineering; and W. A. ZITLAU, vice president, production and transmission.

H. A. Noble
San Diego

C. P. DeJonge
San Diego

J. F. Sinnott
San Diego

W. A. Zitlau
San Diego

ROBERT E. HUNTZINGER from Fremont division plant and service foreman to Sandusky manager and M. E. VERNON from Sandusky manager to southeastern district special representative, Ohio Fuel Gas Co., Columbus.

JOHN KNODLE joined the engineering department of C-B/Southern, Houston - based division of Cooper Bessemer Corp., Mount Vernon, Ohio.

EDWIN M. HUBACH named vice president in charge of domestic and Canadian construction operations and P. D. CAMPBELL named vice president in charge of operations in Europe, Africa, the Middle East and Far East, Williams Brothers Co., Tulsa.

EDWARD E. LYNN from vice president of Fairbanks, Morse & Co. to assistant general counsel, Youngstown (Ohio) Sheet & Tube Co.

HARMON CUTLER named plant manager of Cal-Metal Pipe Corp. of Louisiana, Baton Rouge.

JOHN GETGOOD appointed president of Pacific Petroleums Ltd., Calgary, Alberta, succeeding GEORGE L. MCMAHON, named vice chairman of the board.

LEWIS C. HOLDER joined Trunkline Gas Co. as Houston district landman.

C. D. RICHARDSON is superintendent of the newly created Pennsylvania storage department of Transcontinental Gas Pipe Line Corp., Houston. On the Williamsport, Pa.-headquartered staff are ROBERT M. DETAMORE, JOHN S. NOEL, W. L. SUMMERS JR., and FRED LYDIC.

LEONARD E. BODENHAMER appointed to the Tulsa Mid-Continent district sales office of Cal-Metal Pipe Corp. of Louisiana, Baton Rouge.

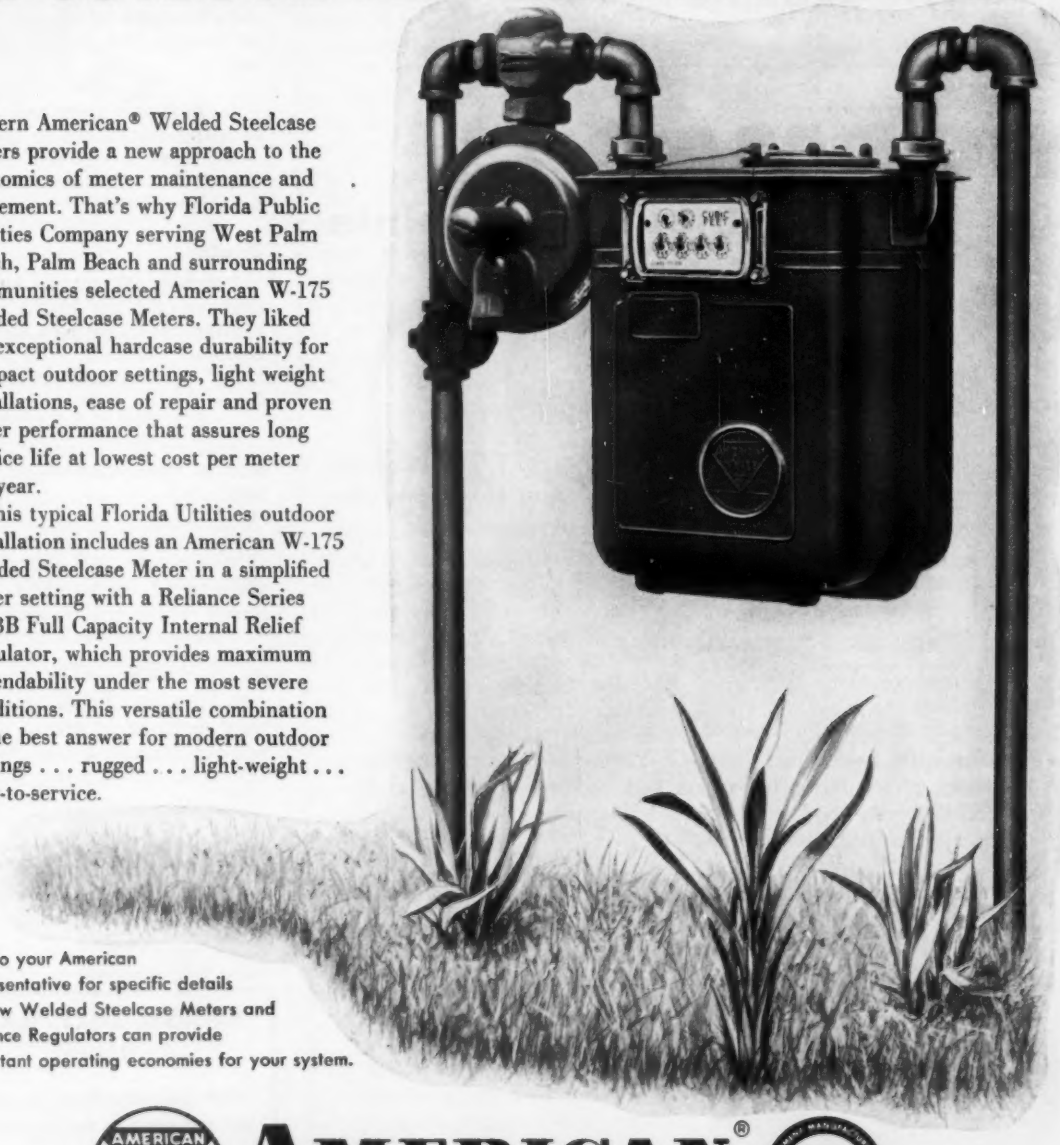
W. D. BRYSON elected a vice president of Solar Aircraft Co., San Diego, Calif. subsidiary of International Harvester Co.

The World Over
—wherever there is gas
ARCCO-ANUBIS
'Dry-Air GAS
GRAVITOMETERS
This new Arcco-Anubis Dry Air Gas Gravitometer determines and records specific gravity of gases automatically corrected to the humidity content of the air. The difference in weight between a column of GAS and equal column of DRY AIR is measured. This ratio represents the true specific gravity of the sample.
One bell of the instrument is filled with gas which is being measured, and the other bell is filled with dry air. Otherwise, except for the new instrument having one column for gas and one column for dry air, the unit is identical in operation to the standard gas gravitometer. When calibrated and properly installed, these instruments require little attention other than to wind the clock, ink the pen, and change the chart. Send for bulletin No. 101 R-4.
ARCCO
INSTRUMENT COMPANY, INC.
7144 EAST CONDOR STREET · LOS ANGELES 22, CALIF.
MANUFACTURERS OF PRECISION INSTRUMENTS

COMPACT WELDED STEELCASE METERS FOR OUTDOOR FLORIDA SETTINGS!

Modern American® Welded Steelcase Meters provide a new approach to the economics of meter maintenance and retirement. That's why Florida Public Utilities Company serving West Palm Beach, Palm Beach and surrounding communities selected American W-175 Welded Steelcase Meters. They liked the exceptional hardcase durability for compact outdoor settings, light weight installations, ease of repair and proven meter performance that assures long service life at lowest cost per meter per year.

This typical Florida Utilities outdoor installation includes an American W-175 Welded Steelcase Meter in a simplified meter setting with a Reliance Series 1413B Full Capacity Internal Relief Regulator, which provides maximum dependability under the most severe conditions. This versatile combination is the best answer for modern outdoor settings . . . rugged . . . light-weight . . . easy-to-service.



Talk to your American representative for specific details on how Welded Steelcase Meters and Reliance Regulators can provide important operating economies for your system.

AMERICAN® METER COMPANY

INCORPORATED (ESTABLISHED 1836)

GENERAL SALES OFFICE: Philadelphia 16, Penna. • Albany • Atlanta • Baltimore • Birmingham • Boston • Chicago • Dallas • Denver • Erie • Houston • Kansas City Los Angeles • Minneapolis • New York • Omaha • Pittsburgh • San Francisco • Seattle • Tulsa • Wynnewood. **IN CANADA:** Canadian Meter Company, Ltd., Milton, Ontario Calgary • Edmonton • Montreal • Regina • Vancouver. **SUPPLIERS TO THE GAS INDUSTRY** for Ironcase, Tinned Steelcase, Aluminumcase, and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves

AARON H. GRIFFIN succeeds W. O. DAVIS as manager of Texas Gas Transmission Corp.'s Louisiana division in Lake Charles. Davis transfers to Memphis, where he will manage the pipeline department of Texas Gas' division office.

SETH S. KIDMAN named superintendent of the Baton Rouge plant of Cal-Metal Pipe Corp.

JAY S. HANDLEY elected vice president in charge of drilling, production, and production engineering for Texas Gas Exploration Corp., Houston.

Jay Handley
Texas Gas

A. H. Griffin
Texas Gas

L. T. Sloan
Texas Gas

Robert Meihls
Hill Hubbell

ROBERT G. MEIHLS named district sales manager of the middle Atlantic area by Hill Hubbell Co., Cleveland.

L. T. SLOAN from assistant division superintendent in the pipeline department to assistant manager of Texas Gas Transmission Corp.'s Louisiana division.

Deaths

TOM P. WALKER, 69, retired chairman of the board of Transcontinental Gas Pipe Line Corp., in Houston. Walker, who retired in 1958, was president of Transco from 1953 to 1957.

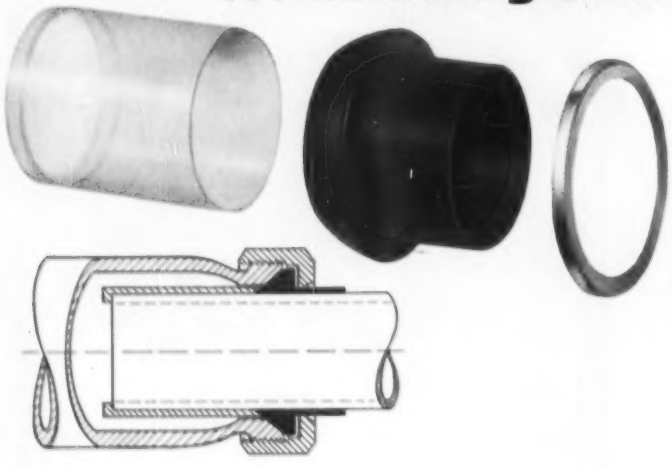
RUSSELL M. RIGGINS, 66, president of Texas Gas Corp., in Houston.

FRANCIS A. LONEY, 66, manager of Philadelphia Electric Co.'s claim division, in Philadelphia after an illness of several months. Loney would have completed 50 years with Philadelphia Electric on Jan. 25.

ROBERT H. KNOWLTON, 78, retired chairman of the board of Connecticut Light & Power Co., Berlin, Conn. Knowlton went to CL&P in 1926 from United Gas Improvement Co. At Connecticut he served as vice president, executive vice president and president. A director since 1935, he was a member of CL&P's executive board until his death.

NORMAC

...Insulating Joints



Normac insulated couplings and fittings incorporate the use of a semi-insulating gasket and Nylon insert combination, or a full rubber insulating gasket. Nylon has a very high dielectric strength, while the insulating gaskets themselves have low carbon content to give the maximum insulation possible.

...Bead Tipped Gaskets

Normac has improved bonding efficiency immeasureably by exposing the maximum area of the beads Under compression the Normac hardened brass beads bite with maximum efficiency into both the pipe and the fitting. This results in a joint of low resistance

New Normac bead tipped gaskets require no burnishing

NORTON - McMURRAY Mfg. Co.

919 N. Michigan Ave • Chicago 11, Ill.

NATIONAL SALES MANAGER WANTED

With wide experience in marketing and sales to the gas industry.

•

This is a responsible position with a major manufacturer of plastic piping. Reply to

BOX 1635, GAS MAGAZINE
198 S. Alvarado Street, Los Angeles 57, Calif.

Model G

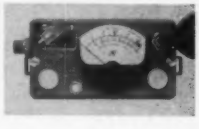
Model H

Testing barhole for gas leakage

Two J-W portable gas detectors give reliable, trouble-free service

J-W SNIFFER, Model G, is used for a general-purpose combustible gas detector. Scale is graduated from 0-1.0 l.e.l. (lower explosive limit) for all common gases and vapors. Light in weight (4 lbs.), simple to use and maintain.

J-W GAS-POINTER, Model H is ideal for testing barholes for underground leaks in natural gas lines. Also used for testing manholes, valve boxes, etc. Two scales: 0-1.0 l.e.l. and 0-100% (pure) gas. Exclusive design eliminates electrical switching or zero shift when changing from one range to the other.



Descriptive literature on request.

J-W **Johnson-Williams, Inc.**
Palo Alto 11, California

Synonymous with safety since 1927

Canadian customers please write:
Safety Supply Co., Toronto, Ont.
Fleck Bros. Ltd., Vancouver, B.C.

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regulatory • *Cont'd.*

from page 12

for the ultimate decision. It is difficult for them to do otherwise, for as the analysis of the work load of one commissioner indicated, he had to make a decision during his workday every five minutes, or as another commissioner recently testified, he made 18,000 decisions in five years. The fact is that delegation on a wide scale, not patently recognized by the law, characterizes the work of substantially all the regulatory agencies and certainly all the major ones. Absent such delegation, the work of these agencies would grind to a stop."

The formulation of policy within FPC has failed concerning gas producers says Mr. Landis. Policy formulation includes the process of making decisions, and it covers the planning of measures to dispose of pending problems and looking for solutions to problems still on the horizon.

• Remedies for FPC delay, costs and agency organization

Mr. Landis reports that: "The Federal Power Commission without question represents the outstanding example in the federal government of the breakdown of the administrative process. The complexity of its problems is no answer to its more than patent failures. These failures relate primarily to the natural gas field, in the commission's handling of its responsibilities with respect to the transmission and the production of natural gas. Enough has already been said about the delays in this field, so terribly costly to the public and so productive of un-

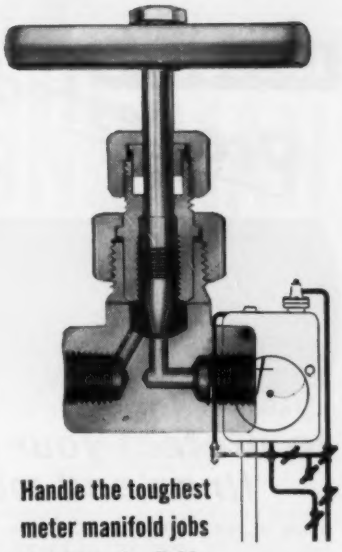
Position Available
Experienced Natural Gas Distribution System Operator

Gas manager position available to qualified person in prosperous Iowa community. Six to eight years' experience required in gas distribution system operation, maintenance, appliance adjustment and inspection. Position will require control of gas loads, meeting public as cities gas representative and manager, and other management and inspection duties.

Address replies and resume of qualifications to City Clerk, Graettinger, Iowa

For dependable field service

SPECIFY AMERICAN® NEEDLE VALVES



Handle the toughest meter manifold jobs and corrosive field services. Eliminate gland leaks.

Teflon-packed forged steel American® Needle Valves deliver year 'round dependable service—stand up under all conditions. Stainless or carbon steel precision machined valve bodies are ideally suited for welding. Stainless steel centerless-ground valve stem design makes it simple to repack valves under pressure.

Standard valves are design rated for pressures to 5,000 psi at 70°F. Upon request, assembled valves are hydrostatically tested to 10,000 psi (twice rated working pressure) and individually inspected. Valves are also furnished with graphite-impregnated asbestos packing for temperatures above 450°F.

Angle or straight patterns—screwed or union bonnets.

Ask your American Meter representative for full details.

AMERICAN® METER COMPANY
INCORPORATED ESTABLISHED 1836

General Offices:
Philadelphia 16, Pa.
Sales offices in principal cities.

employment in other basic industries.

"These defects stem from attitudes, plainly evident on the record, of the unwillingness of the commission to assume its responsibilities under the Natural Gas Act and its attitude, substantially contemptuous, of refusing in substance to obey the mandates of the Supreme Court of the United States and other federal courts.

"The commission has exhibited no inclination to use powers that it possesses to get abreast of its docket. Thousands of rate cases dealing with independent gas producers clutter its docket. Of this mass of cases Sen. Paul H. Douglas of Illinois has pointed out that an exemption of producers of natural gas in interstate commerce for resale of less than 2 billion cu ft per year would take 4191 producers, whose total production of natural gas was only 9.26 per cent of the total volume of gas purchased by interstate pipeline companies in 1953, out of the jurisdiction of the commission. The portion of the total production accounted for by these small producers may have varied slightly since then but still remains insufficient to require them to be subjected to regulation in order to provide adequate protection to natural gas consumers against monopoly prices. Nevertheless, no effort has been made by the commission to clear its docket of these inconsequential cases in order to come to grips with the relatively few remaining producers who do matter.

"The recent action of the commission on Sept. 28, 1960, in promulgating area rates, whether ultimately legal or not, has come far too late to protect the consumer. The area prices there set forth substantially reject the rate base approach and the fixed area prices come close to approximately current maximum prices, which have more than doubled in the past five years. The commission's past inaction and past disregard of the consumer interest has led the states to seek to force it to discharge its responsibilities. It is somewhat of a phenomenon in our national life for the state utility commissions to be ranged against a federal commission in an effort to protect consumers against monopolistic and excessive rates. That, however, is today's picture of federal regulations of the natural gas industry.

"The transmission side of that industry presents the same picture. Delay after delay in certifications and the prescription of rates has cost the public millions of dollars.

"An example of the inability of the commission to control the disposition of its business is afforded by the following:

"A substantial number of certificate filings made by independent producers and pipelines request nothing more than the authority to make increased or additional sales of natural gas to existing customers or to customers within the same areas. These applications do not pose complex problems, but the paperwork and the dozens of steps taken while processing those applications contribute materially to the backlog which presently confronts the commission. Not only do these relatively minor cases stack up, but

LASCOPIPE

Pre-tested! Signed! Dated!

to protect your service lines and mains

MARK OF PRE-TESTED QUALITY is the dated code number printed on every foot of Lascopipe ABS and PVC Plastic Pipe. It means that test sections of pipe *cut from the same production run* have withstood tremendous shock, impact and internal and external pressure tests in Lasco's quality control laboratory... test conditions far worse than anything the pipe in your gas service lines and mains will ever face.

Production samples of Lascopipe are subjected to harsh impact and burst tests to insure high tensile strength and resistance to sharp blows and hard usage. They are completely flattened in a test vise... and must show no signs of cracking. The test pipe must survive a chemical submersion test without any indication of deterioration. Every length of pipe is checked with Lasco's exclusive gauge block and micrometer to assure exact dimensions.

These are not "once-upon-a-time" or "every-now-and-then" tests. They are a scheduled part of every production run of Lascopipe. The quality test history of the Lascopipe you buy is available on record for your inspection.

Only the finest 100% virgin resins go into Lascopipe. It is extruded on the latest equipment, utilizing induction heating to assure constant temperature control and stabilization... Lascopipe is always stress relieved.

Lascopipe (ABS and PVC) comes in standard 20-foot lengths and standard diameters for gas service lines and mains. A complete line of fittings is available. Complete technical data is yours for the asking. Write Lasco Industries, 1561 Chapin Road, Montebello, California.

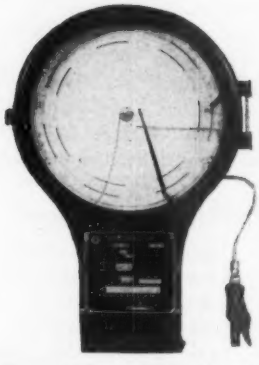
Lasco Pipe

LASCOPIPE

How these gauges guard your demand metered services

Many gas utilities have established penalty rates for gas used during peak periods. Accurate records are needed to prove these demands—also to show areas where excessive usage is causing pressure deficiencies.

The two Rockwell gauges pictured below provide inked records which verify use and furnish both volume and pressure data. For additional information write: Rockwell Manufacturing Company, Dept. 60-C, Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Co. of Canada, Ltd., Box 420, Guelph, Ont.



ROCKWELL TYPE "T" EMCORECTOR—chart is clock driven. One pen traces an accurate record of pressure against time. A second pen records volume in units of either 1,000 or 10,000 cu ft. Two straight reading indexes are provided—one for actual displaced measurement while the other automatically corrects this to base pressure volume.

ROCKWELL COMBINED RECORD GAUGE. Has clock driven chart on which two pens trace (1) gas usage in units of either 1,000 or 10,000 cu ft and (2) gas pressures. These increments can be calculated, if desired, to correct to base pressure volume.

VOLUME AND PRESSURE GAUGES

another fine product by

ROCKWELL

also their presence delays commission action on the other vital matters before it.

"At the specific request of the commission, the Congress amended the Natural Gas Act in order to provide a simplified procedure to cope with problems in this category. In 1942, in response to the commission's urgent pleas, Congress enacted Section 7(f) of the Natural Gas Act which provided, in the plainest terms, that the commission should determine 'the service area' for a regulated company, and 'Within such service area as determined by the commission a natural-gas company may enlarge or extend its facilities for the purpose of supplying increased market demands in such service area without further authorization.' "

"Under the procedure presented by Section 7(f), the commission could readily eliminate thousands of unnecessary requests for authorizations. For example, even though an independent producer holds a certificate to sell gas to a pipeline from certain leases, the subsequent acquisition of additional leases requires the independent producer to obtain further authorization in order to increase its sales to the same pipeline. There is not a single instance in which this authority has ultimately been denied. Nevertheless, the commission has needlessly required the filing of separate applications.

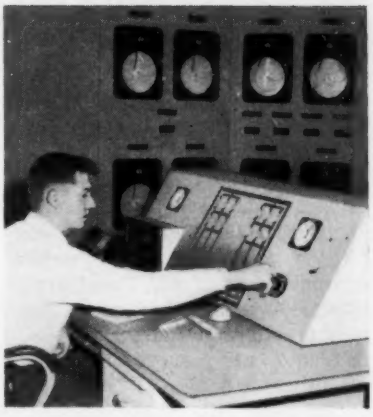
"Similarly, the commission requires the complete gamut of pleadings and processing in order to enable an established producer to sell gas from a new well to an established pipeline at a price completely in line with prices theretofore certificated.

"An identical problem is posed to a pipeline which wishes to meet

Position Available
Experienced Natural Gas Distribution System Operator

Gas manager position available to qualified person in prosperous Iowa community. Six to eight years' experience required in gas distribution system operation, maintenance, appliance adjustment and inspection. Position will require control of gas loads, meeting public as cities gas representative and manager, and other management and inspection duties.

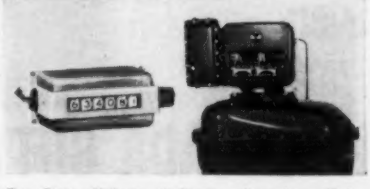
Address replies and resume of qualifications to City Clerk, Manning, Iowa



ONE MAN

does the work of many with AMERICAN® telemetering-telecounting equipment

American telemetering and telecounting equipment substantially reduces personnel required for transmission of meter readings. From a central dispatching station, one man instantly obtains accurate flow and pressure readings at remote points and adjusts for load demands with remote-set controllers.



For Base Volume Indexes—American Telecounters accurately transmit Base Volume Index indications of gas quantities computed to base temperature and base pressure conditions, to remote locations.

For further information consult your American Meter representative.

AMERICAN® METER COMPANY

INCORPORATED (ESTABLISHED 1836)

General Offices: Philadelphia 16, Pa.
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the increased requirement of a distributor, even though no change in rate is involved.

"It was to do away with these problems that Section 7(f) was enacted. Nevertheless, during the 18 years that provision has been in the statute, the commission has not utilized it on a single occasion.

"In early 1942, applications were filed by five pipelines for service area determinations. Those applications have not been acted upon to this date. Of course, the same is true of every subsequent application under Section 7(f).

"In 1944, the commission attempted to justify its inaction on grounds that the wartime conditions required all available manpower for other purposes. However, the commission added: 'This work, on the determination of service areas should be pressed forward as vigorously as possible, as soon as the exigencies of war make it practicable for the commission and the companies to conduct the necessary investigations and hearings.'

"Despite this and subsequent pious expressions, the commission has literally done nothing to reduce the delays which have constantly increased. Instead, when Congress requested action the commission merely addressed a letter on May 8, 1946, to all natural gas companies requesting their views regarding administration of the service area provision of the act. The commission simply ignored the replies.

"In January, 1947, the commission's staff prepared and submitted an extensive report to the commission strongly recommending implementation of Section 7(f), and recommended the preliminary action be taken forthwith 'to effectuate the intent of Congress expressed in Section 7(f).'

"If the commission has any legitimate reason for its 18 years of failure to implement Section 7(f), it has not given any expression thereto. Moreover, any possible criticism of the service area procedure provided by Congress at the commission's request could readily be handled by the attachment of suitable conditions to service area determinations.

"Other instances of ineffective administration are legion. Indeed, the dissatisfaction with the work of the commission has gone so far that there is a large measure of agreement on separating from the commission its entire jurisdiction over natural gas and creating a new commission to handle these problems exclusively.

"It is probably unnecessary to go this far. However, certain amendments to the Natural Gas Act are essential. The commission might well be increased to seven members so as to permit it to sit in two panels of three, with final decision in each panel, so as to help it clear up its enormous back log. But primarily leadership and power must be given to its chairman and qualified and dedicated members with the consumer interest at heart must be called into service to correct what has developed into the most dismal failure in our time of the administrative process."

• Remedies on Personnel

The Landis report repeats the common knowledge that regulatory agencies must find ways to attract better personnel. It states that: "The prime key to the improvement of the administrative process is the selection of qualified personnel. Good men can make poor laws workable; poor men will wreak havoc with good laws.

"As long as the selection of men for key administrative posts is based upon political reward rather than competency, little else that is done will really matter. Thus, the real issues are two: (1) are these posts sufficiently attractive to draw good men, and (2) how can these men be found?

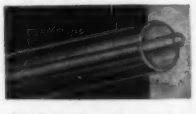
"Good men are primarily attracted by the challenge inherent in a job. Salary is a secondary consideration, provided only that it is high enough to enable them to meet reasonable standards of living comparable to their positions in the society. Our universities have known and, indeed, traded on these facts. Tenure is another consideration of more importance than salary, for with tenure goes independence and the opportunity for long-range planning."

Length after length . . . Mile after mile . . . Every inch of

BUSADA BUTYRATE (PLASTICS) GAS PIPING IS IDENTICAL!

IT'S CLEAR! YOU CAN SEE IT'S BY Busada

It is transparent . . . made from one specific material formulation containing the same physical properties shipment upon shipment. Its high quality is constant. Made to same O.D. as steel pipe with 2 wall thicknesses. Close tolerances insure leakproof, trouble-proof ease of installation. Complete line of fittings.



Butyrate pipe now available in black

Made by Busada Mfg. Corp., for

BUSADA SUPPLY CO. INC. 32-21 DOWNING STREET FLUSHING 54, NEW YORK

Representatives in: Boston, Los Angeles, Shreveport, La., Kingsport, Tenn., Kalamazoo, Mich.

The most serious problem surrounds the *ex parte* presentations to commissioners by those who represent participants in pending cases. Mr. Landis says that: "Executive action would have the virtue of defining with some degree of particularity what conduct would constitute grounds for removal from the public service by the President or other persons empowered to remove public servants for cause. It would also presumably furnish a criterion for the action of professional associations, such as bar associations or boards of accountancy, in disciplining their members. It would not, however, reach the worst source of these presentations, namely the regulated industries themselves except insofar as their presentations might be made by persons in the organized professions. It would also not extend to Congressmen and Senators.

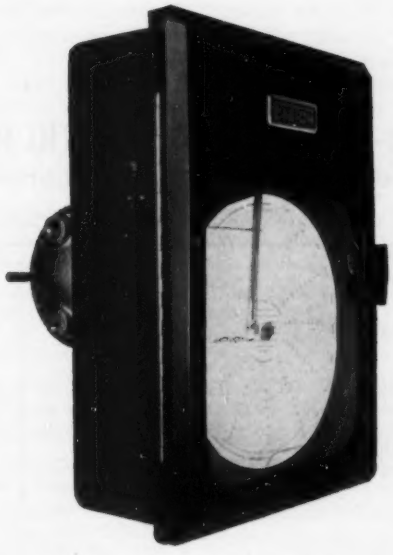
"The only way in which these latter categories could be reached would be by the legislative creation of criminal sanctions. The objections to doing so lie in the difficulty of defining the crime and the difficulty of convicting guilty offenders. The latter is probably a difficulty but not a valid objection to action. Convictions under our anti-lobbying statutes are rare but they nevertheless have been useful in reducing the blatant lobbying practices that preceded their enactment.

"Presidential action by way of executive order in this field appears desirable even though it is necessarily limited in its impact."

About leanings toward the industry being regulated Landis reports: "Industry orientation of agency members is a common criticism, frequently expressed in terms that the regulatees have become the regulators. Of course, if this type of orientation characterizes an individual prior to his appointment, there is little that can be done about it. But the real problem relates to those who are originally oriented towards the public interest but who gradually and honestly begin to view that interest more in terms of the private interest." * * *

"Irrespective of the absence of social contacts and the acceptance

THE FLOW RECORDER YOU CAN COUNT ON



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of undue hospitality, it is the daily machine-gun-like impact on both agency and its staff of industry representation that makes for industry orientation on the part of many honest and capable agency members as well as agency staffs. A device, employed in some agencies, is some protection against this tendency. This is the device of the public counsel, the effectiveness of whose function is in almost direct relationship to his capacity to irritate the agency members. It should be encouraged, however, and the public counsel, in those cases where he has intervened, should be granted the right of seeking review from the decisions of trial examiners to the agency itself on terms accorded to the parties themselves, although a right to seek judicial review of decisions that have achieved finality should naturally be denied him since the public interest has presumably by that time coagulated in the agency's decision."

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Property		Values in Units	Test Methods[1]
TENSILE STRENGTH[2]	−40 F	7800 lb./sq. in.	D638-58T
	73.4 F	5100 lb./sq. in.	
	160 F	3300 lb./sq. in.	
FLEXURAL STRENGTH[3]	−40 F	No Failure	D790-58T
	73.4 F	No Failure	(b)
	160 F	No Failure	
FLEXURAL YIELD	−40 F	11,000 lb./sq. in.	D790-58T
	73.4 F	7,400 lb./sq. in.	(c)
	160 F	4,700 lb./sq. in.	
HARDNESS[3], ROCKWELL R		86	D785-51
IMPACT STRENGTH[2]	−40 F	2.5 Ft. lbs.	D256-56
(Izod-Notched)	−20 F	4.5 Ft. lbs.	(Method A)
	73.4 F	8-10 Ft. lbs.	
FLAMMABILITY[3]		1-1.5 In./min.	D635-56T
SPECIFIC GRAVITY[3] (BLACK)		1.04 g/cc @ 73.4 F	D792-50
COEFFICIENT OF LINEAR THERMAL EXPANSION		6x10^{-5} inches/in./F	D696-44

1. Tests have been performed by ASTM methods. Data shown are average values and should not be used for specifications.
2. Values shown are based on injection molded specimens.
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• Revise procedure

The time is approaching for improvement in administrative procedure. Mr. Landis asserts: "Much work has been done in the field of improving administrative procedures since the passage of the Administrative Procedure Act of 1946. These improvements were preceded by intensive research and study. The chief contributors in this field have been organizations such as the Hoover Commission and various bar associations, scholars and individual practitioners. Much of the thinking by now has been fairly well crystallized and should soon be ready for formulation into legislation and administrative rules of practice and procedure. The difficulty presently is the absence of continuing effort and the lack of a point where such effort can be focalized so that action will ensue." * * *

"On Aug. 29, 1960, the President requested Judge Prettyman of the Court of Appeals for the District of Columbia Circuit to undertake the preliminary work of organizing such a conference. Judge Prettyman in turn appointed a committee of 14 members and has ready a preliminary draft of by-laws for such an organization.

"This work should be encouraged and Judge Prettyman, whose knowledge of and devotion to the subject is well-known, should be requested to continue his efforts. Much can come from this effort, including not merely revisions in our administrative procedures but also the making of our regulatory agencies into a system just as the Judicial Conference of the United States has made a system of what were once isolated and individual federal courts. But for a conference of this type to be effective it is essential that a permanent secretariat be established, which can follow the work of various committees, break out issues and problems that require exploration and research, arrange for appropriate publications, and act as liaison agent between the conference, Congress and the government generally.

"The work and functions now lodged in the Office of Administrative Procedure in the Department of Justice should be transferred to this secretariat for the statistics

can there be refined and reworked so as to make them significant to the operations of the conference. A second function now vested in the Civil Service Commission, that of the qualification and grading of hearing examiners, could also be transferred to this secretariat. The situation presently is admittedly a not too happy one. The Civil Service Commission is not fundamentally organized to handle this problem. The extremely important goals of maintaining the independence and integrity of the hearing examiners and of evolving a corps of highly qualified examiners can better be achieved through an arrangement of this character rather than leaving these problems to the Civil Service Commission.

"Experiments in the flexibility of handling this corps and promoting a better use of examiners through an effort to make them at least partly fungible could be carried on by the secretariat and could make for uniformity and improvement in administrative procedures through the interchange of experience and knowledge. The secretariat could also be a central spot for the recruitment of lawyers for the government, particularly for the regulatory agencies.

"The concept of an Administrative Conference of the United States promises more to the improvement of administrative procedures and practices and to the systematization of the federal regulatory agencies than anything presently on the horizon."

- **The coordination of agency policy**

Reorganization in an appropriate governmental unit is visualized by Mr. Landis for the industries of transportation, communications and energy. He says: "Coordination of agency policy is meaningless in the absence of the internal development of policy by the individual agencies. The lack of such development in recent years has been commented upon and, in previous sections methods have been suggested as how that deficiency could be cured, namely the evolution of new procedures, the strengthening of planning divisions and the relief of agency members themselves from the multitudinous and frequently

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Pipe Line (West Texas). Experience indicated that leaks would become an increasing problem. Protection was required. CSI installed 600 magnesium anodes in only 10 days.

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29 Oil Wells (West Texas). One casing leak had already occurred in this field. CSI installed protective systems using special new rectifiers that deliver almost constant current output despite heavy rains or dry periods.

30 Oil Wells (Western Kansas). CSI determined current needed to stop corrosion; then installed 6-ampere-output rectifiers on a turnkey basis. Cost: $300-$350 per well.

116 Oil Wells (West Texas). 2 casing leaks had resulted from external corrosion in this field. CSI ran current requirement tests, then installed rectifiers and graphite anodes on each well. Cost was only $300 to $350 per well.

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minor duties that they are required to perform." * * *

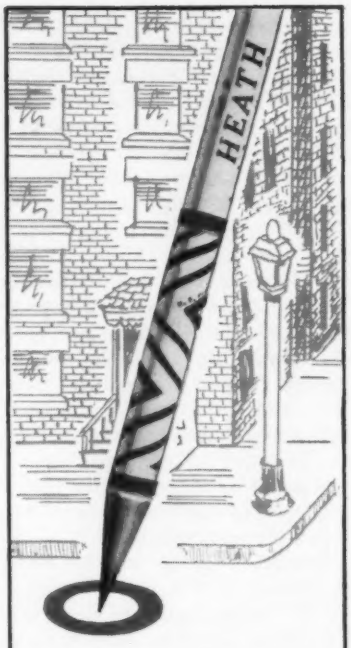
"Meanwhile, development of the coordinating function could be placed in the Executive Office of the President. It should not be vested in a White House assistant because such coordinating activity needs protection from trivia, from personality conflicts and even from politics, as well as the objectivity of approach that can be given the coordinating authority by vesting it in an office already constituted to perform staff and not personal functions for the President. The office would need no regulatory powers. It does need the constant personal support of the President and through him the President's Cabinet and the Bureau of the Budget. Given these, a coordination of policy can be effected by such an office among the various regulatory agencies, implemented where necessary by executive order. And, as experience demonstrates, coordination and consolidation of functions among them can be effected by the wise use of the President's power under the Reorganization Act." * * *

"In the energy field, however, emphasis should be placed upon the development of new sources of energy such as the hydrogenation of coal and oil-bearing rocks and also upon the wider employment of atomic energy. In the light of our dwindling water resources the need for energy to distill fresh water from the sea to make our arid areas fertile, is a commanding objective—a new frontier of untold significance to us and the world."

• Relationship of the agencies

Cooperation between the executive and Congress to improve the efficiency, foresight and productivity of regulatory agencies is expected by Mr. Landis. He asserts: "The policy planning of those agencies engaged in the areas of transportation, communications, and energy, respectively, would be geared to the President as indicated through the offices to be established in the Executive Office. These offices concern the coordination of policy.

"The development of detailed plans for the reorganization of the administrative agencies and continued oversight of these activities



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remains to be considered. Such oversight as is exercised by the Bureau of the Budget is at too low a level and extends substantially only to managerial functioning. The areas in which the agencies fail or hesitate to formulate policy presently tend to go unnoticed, as do those overlaps that have developed or are in formulation.

"Congestion of dockets, time-consuming procedures, duplication of facilities and effort, and failures to delegate run-of-the-mine problems all have to be watched. This function of the President must be focused somewhere. * * * The person charged with these responsibilities should not be a mere Inspector-General but also a source of imaginative and creative activity. Lodging that function in the Executive Office of the President independently of the Bureau of the Budget and transferring to that office the functions now exercised by the Bureau of the Budget of managerial assistance is the solution.

"Presidential concern, with the work of the agencies, is important both from the standpoint of the President's duty to see that the laws are faithfully executed and from the standpoint of the morale of the agencies for they will then realize how important their activities are to the national scene. To neglect these agencies is to encourage the centrifugal tendencies inherent in the 'administrative branch' of the government and to lessen their capacity to draw good men into their service.

"Their relationship to the Congress would similarly be improved * * *. Congress will still have to concern itself with innumerable details, for details are the grist of the legislative mill. But in exercising its general functions of oversight, the function that President Wilson termed one of the most important of the duties of the Congress, the woods are too often obscured by the trees."

- **Landis' recommendations for FPC**

Some of Mr. Landis' recommendations can be adopted by the FPC, and others can be incorporated in his plans for reorganization. The Landis report makes a bid for de-

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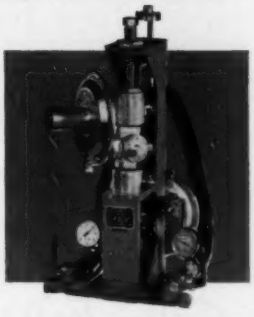

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veloping high level policy now. It states: "The present needs are too pressing to await the initiation of what would be a mammoth project of consolidation in the fields of transportation, communication, and energy, and even a huge project in any one of them. The prime and immediate need in these fields is for developing and coordinating policy immediately at a high staff level. Operations for the moment can be left to the existing agencies, whose conduct should in the light of these recommendations show marked improvements. If experience later would dictate the desirability of the consolidation of certain operating functions, they will then have become sufficiently identified and understood to enable their intelligent consolidation in an appropriate departmental structure. To attempt such consolidation in the absence of the experience that would be derived from determined effort to evolve policy through coordination directly under the President, would be substantially to plan *in vacuo*. The creation of a mechanism for staff coordination can and should begin now. Its staff work as envisaged herein will carry within itself means for the implementation of its directives.

"With this thought in mind, the following recommendations are made:

"1. Secure for the President from the Congress the right to propose reorganization plans pursuant to powers heretofore granted the President under the Reorganization Act of 1949, subject to veto by a concurrent resolution of both Houses of the Congress. The powers to propose plans should be available for a minimum of two years but preferably for four years. * * *

"3. Propose a reorganization plan for the Federal Power Commission making clear that the tenure of its Chairman is at the pleasure of the President. * * *

"5. Propose reorganization plans for the same agencies providing for the delegation to panels of agency members, single agency members, hearing examiners or boards of employees for final determination all adjudicatory matters subject only to discretionary review by the agency *en banc* on petition by a party in interest. * * *

"8. Create within the Executive Office of the President with appropriate powers an Office for the Coordination and Development of Energy Policy with authority to propose to the President plans for the development of the energy resources of this nation.

"9. Create within the Executive Office of the President with appropriate powers an Office for the Oversight of Regulatory Agencies which will assist the President in discharging his responsibility of assuring the efficient execution of those laws that these agencies administer. * * *

"13. Impose upon the Office for the Oversight of Regulatory Agencies the duty to prepare for the President detailed reorganization plans for the regulatory agencies with prime emphasis on the Federal Power Commission, the Interstate Commerce Commission, the Civil Aeronautics Board, and the Federal Communications Commission.

"14. Issue an Executive Order dealing with the ethics of government employees and their duty to reject and refrain from receiving *ex parte* presentations in pending matters before them for adjudication on the record, which Order should specifically prohibit any such *ex parte* communication by any person in or part of the offices created under recommendation * * * 8 * * *.

"15. Promote the organization of the Administrative Conference of the United States and subject to the approval of its bylaws initially by executive order and subsequently by legislation provide for the creation of a Secretariat to the Conference, transferring to that Secretariat duties now performed by the Office of Administrative Procedure within the Department of Justice, which would thus be abolished and transferring from the Civil Service Commission to the Secretariat duties now exercised by the Commission with respect to the qualifications and grading of hearing examiners.

"16. Require the submission to the Congress and President of annual reports by the offices created pursuant to recommendation * * * 8 * * * ."

- **Keep FPC independent**

There are many regulatory commission improvements recommended by Mr. Landis, such as reducing delays, adopting policy, attracting better staff and commissioners, and eliminating unethical conduct that we readily support. The threat to the independence of the federal regulatory commissions, however, should be rejected. Placing the FPC directly under a cabinet officer or the President would be an unfortunate blow to the long-established and desirable independence of FPC. ■

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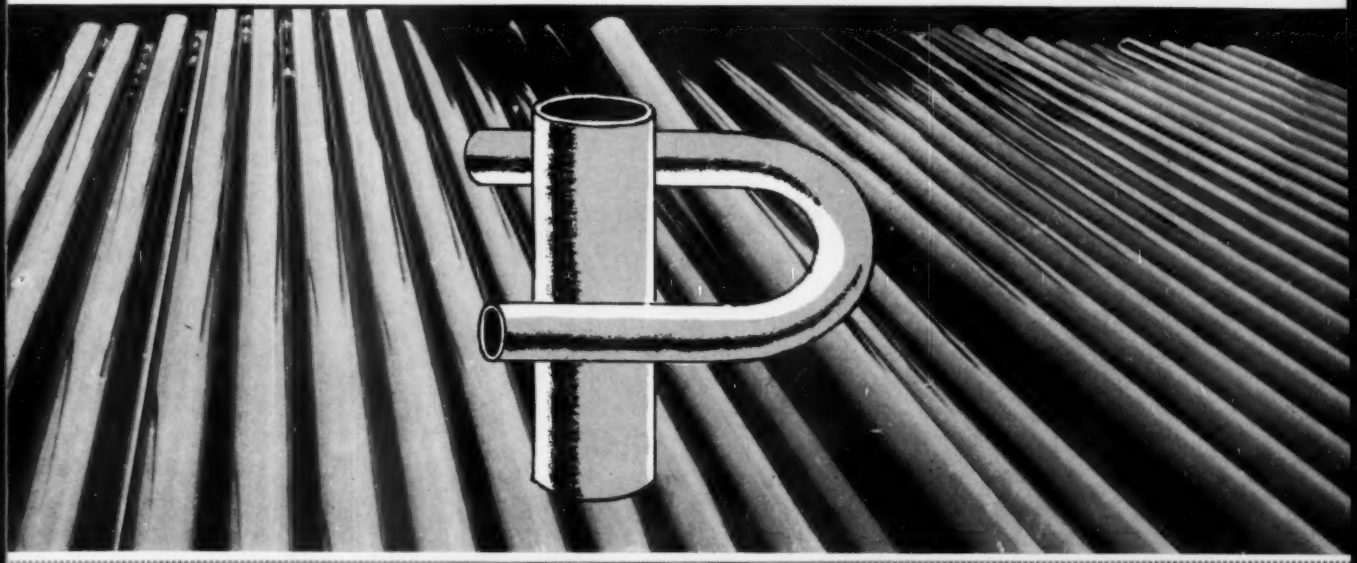

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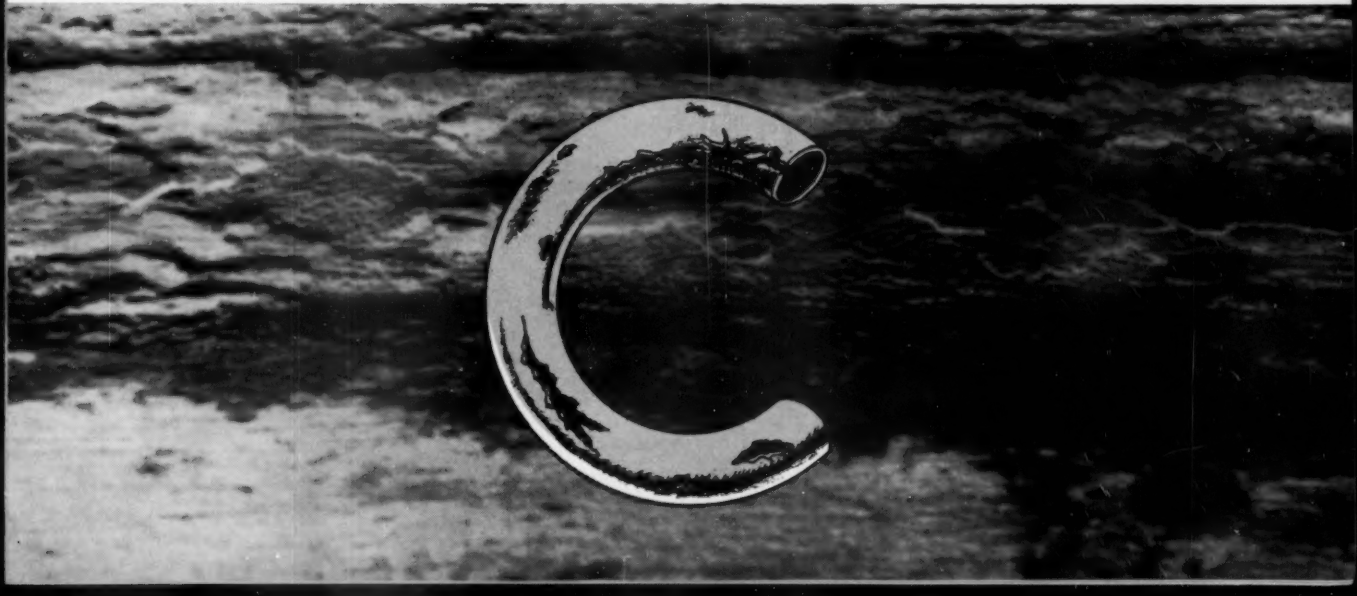

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From this glistening stack of plastics pipe, 40-ft lengths of 6-in. diameter are easily loaded on a truck—by hand.

Plastics Pipe at Phillips

Over one million feet in, another million going in

By R. M. WEAVERLING and LEO B. CROLEY

Commercial Development Engineers
Phillips Chemical Co., Bartlesville, Okla.

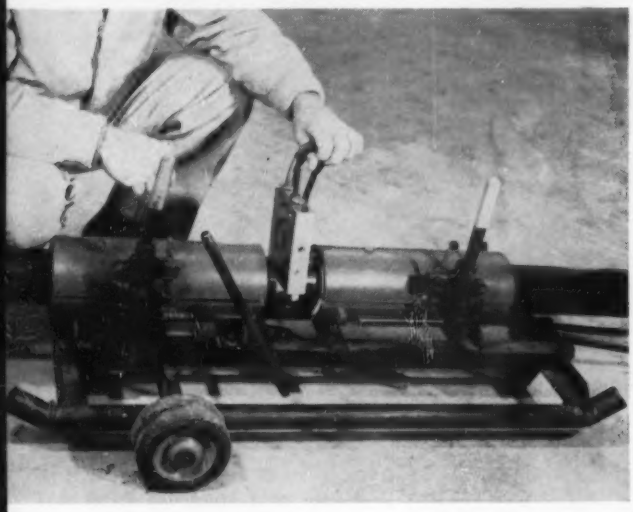
AT this writing, more than 1.1 million ft of high density polyethylene pipe is now in use by Phillips Petroleum Co. in its gas gathering and distribution service. This massive five-year test program points up the immediate practicality of this new material for gas producers and distributors.

Conducted as a joint effort by Phillips Petroleum field engineers, commercial development engineers from Phillips Chemical Co. (a wholly owned subsidiary and producer of Marlex plastics), and Phillips laboratory personnel, the vast test program was made to determine the economies and effectiveness of pipe made of Marlex TR-212 high density polyethylene.

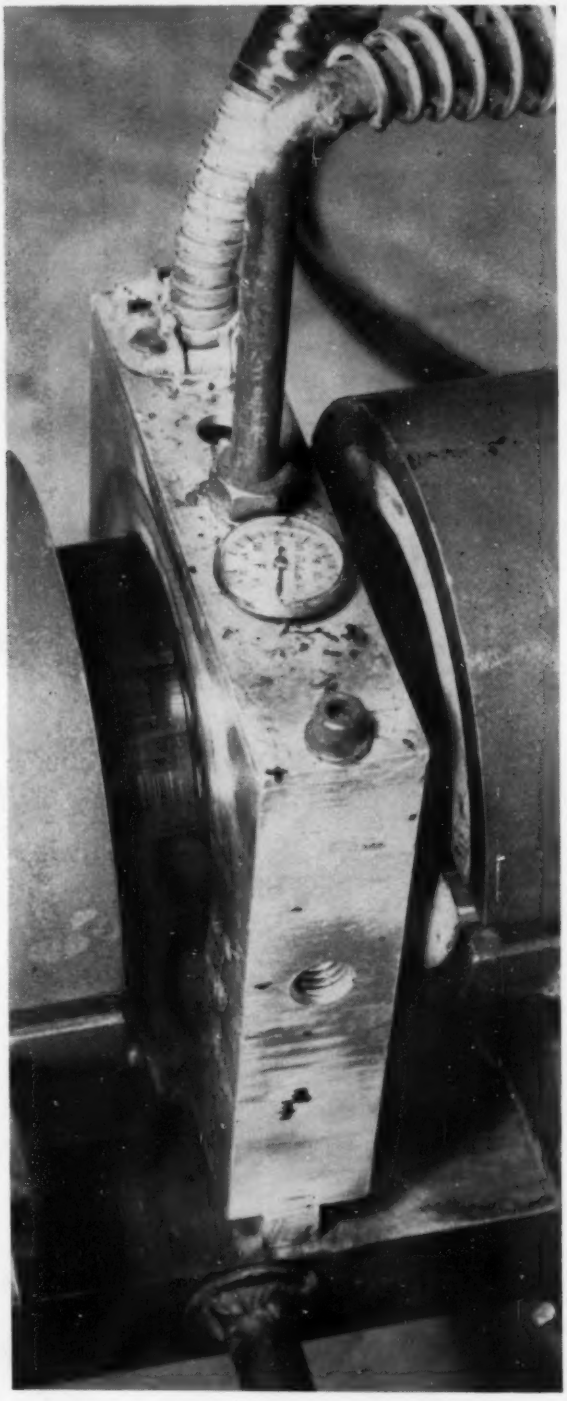
The bulk of this million-plus is in natural gas gathering systems, but the company also has plastics pipe applications in salt water disposal, water supply, and

Phillips Method of butt-fusing plastics pipe

First, the ends of the two sections to be joined are clamped into alignment on a portable jig. Then, as shown here, a clean aluminum heating plate is inserted between the ends. Heated by a gas flame or electricity, the plate reaches a temperature of 390 to 420 deg. as the pipe ends make firm but gentle contact with it.



About 30 seconds of the heating against the plate and a small bead begins to roll back on each pipe-end, as shown in this close-up. When this happens, workmen carefully pull the pipe ends back from the heated plate, remove it, and then gently push the ends together with enough pressure to form a uniform beading around the new joint.



crude oil gathering lines as well. Phillips, however, annually installs several hundred miles of pipe connecting new gas areas with existing gathering lines.

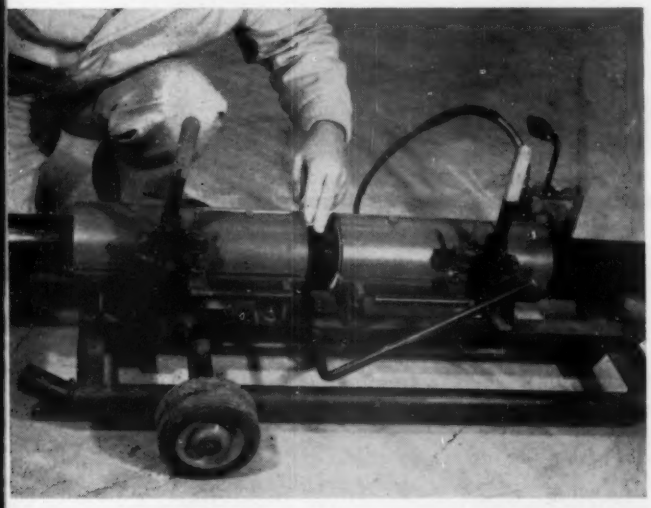
As a result of these tests, Phillips has now made it standard practice to use plastics pipe in all applicable operations.

By the end of 1959, Phillips had more than 500,000 ft in the ground with this figure upped to over 1.1 million at the end of 1960. Our field operations have been with ½-in. through 8-in. pipe, the bulk of it, however, in 3- and 4-in. sizes. Over 700 separate installations cover a variety of uses in all types of terrain.

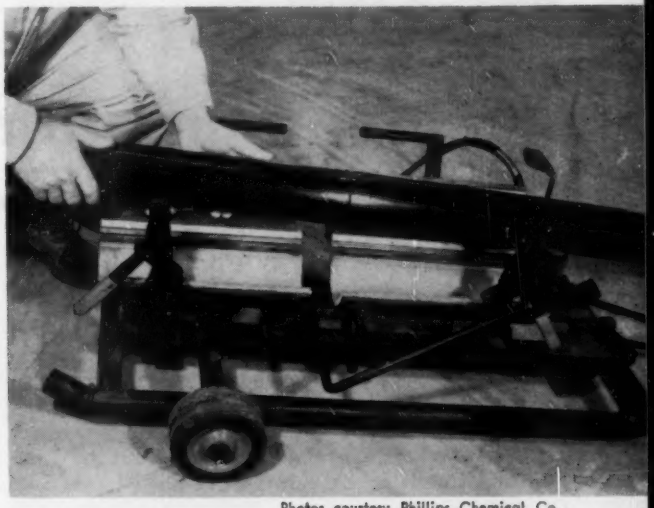
A complete record is kept on each installation, using a special "Marlex Pipe Installation Report" form. This is an 8½- x 11-in. sheet, printed on both sides. There are a total of 62 blanks, but not all pertain to each installation.

Picking out a typical completed form, we chose Installation Number 580. Installed Aug. 1, 1960, by Ferguson Construction, this was a 9750-ft wet gas line for the gasoline department at the Lee plant in Lea County, N. M. Other bits of information filled in at the top of the first page are the contractor number, the line number, and the AFE or other identification. The pipe had an outside diameter of 4½ in., and was Marlex series 5000, type 3. The manufacture date was included in code. Installation was in Caliche

Still clamped in place, the new fused joint is carefully inspected for uniform beading and correct alignment. After only a few days' training, workmen can readily turn out perfect joint after perfect joint, according to Phillips. Company engineers have found that the butt-fused joints have greater strength than the pipe itself.



After the pipe cools for about 20 seconds, the hinged jigs are swung open and the newly joined sections are removed from the the mobile jig. Note the cleanness of the joint and its relatively small size. Larger jigs (the company refers to them as "alignment machines") are available to handle larger pipe.



Photos courtesy Phillips Chemical Co.

with padding consisting of 4 in. of rock-free dirt. Average depth was 12 in. The only fittings used were Ringtite Transite #100 sleeves—for Marlex-to-steel connections. Particular attention was paid to the Marlex - to - Marlex joints, made by the butt-fusion method described in a succeeding paragraph. Conditions at the time were clear and still weather and a 98-deg. air temperature. The fusion equipment was a Cro Mac III with a 1-in. thick aluminum plate heated to 400 deg. by a generator. Time in contact with the Marlex pipe was 40 sec. A 1-hr, 35-psi air pressure test followed with no failures recorded. Last bit of information on the form was the name of the person who prepared it.

Actually, only about half of the blanks were filled in for this installation. Among those left blank were portions on operating pressure and temperature, surface and supported sections, and cost data.

Speed and efficiency of joining lengths of pipe is always important from the standpoint of both economy and ease of installation. To take the greatest advantage of our new plastic material, a new method of joining, butt-fusion, was perfected. The ends of the pipe are cut, squared and placed in an alignment jig. They are then brought against opposite sides of a heated aluminum plate inserted between them until a small bead, about 1/16 in. in diameter, forms and begins to roll back along the pipe from the plate.

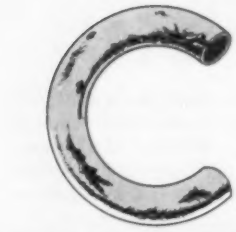
When this happens, the two pipe ends are pulled straight back while the plate is removed. Then the ends are gently pressed together while a reinforcing bead forms both inside and outside the pipe. Only 30 seconds is required for the joint to cool and then the joined section is ready for use.

In laying the approximately 1.1 million ft of pipe, some 30,000 joints were made using the butt-fusion technique. A cost analysis showed that the butt-fusion joint costs less than one-third as much as a welded steel joint. Maintenance reports showed failure occurred in only 10 of the 30,000 joints. No failures occurred in the lines themselves—excluding six caused by mechanical damage, such as being accidentally exposed and hit by a bulldozer.

Throughout the duration of our field test program, laboratory tests were concurrently conducted to determine stress rupture life data. Conducted in wet and dry natural gas environment, they confirmed that high density polyethylene pipe is suitable for the gathering and distribution of natural gas at pressures and temperatures normally encountered. They also proved that mercaptans, foggy oils and other additives have no effect upon the pipe.

We feel that Marlex with the new joining technique presages the general adoption of high density polyethylene pipe in the gas production and gas distribution industries in the near future. ■

By WILLIAM HARPER • Eastern Editor



'61

Mile of aluminum pipe installed by United Fuel Gas to evaluate corrosion resistance and new welding and installation techniques

Short aluminum line put to bed

PIPELINES: arteries of the natural gas industry. Over the years, they have been made of bamboo, wood, wrought-iron, steel and plastics. A late development is the use of aluminum pipe. In mid-January, the Appalachian Mountains area got its first permanent aluminum pipeline when United Fuel Gas Co. completed a construction project near Phelps, Ky.

The new line was laid in UFG's southern production district to connect a new gas line with the company's gathering system. The project consisted of installing some 5700 ft of schedule 40, 4-in. OD Aluminum Co. of America (Alcoa) pipe in just about the most rugged terrain UFG could find in its system. And, if you will ask any pipeliner who has ever worked the West Virginia-Kentucky mountains, you find it can get quite rugged.

However, that was exactly the reason this site was chosen. As UFG corrosion engineer William Lambert put it, "If we can put this line in here, we can put it in anywhere." It is this observer's opinion that truer words were never spoken. Just name the kind of pipelining conditions desired (or rather, undesired), and most are present through this one-mile stretch of Kentucky.

Hills, mountains, 50-deg. slopes, flat lands, coal seams, streams, rocks, sand; they are all there. Hoyt Hannah, a United pipeline engineer, said, "We have everything here but a gob pile and we'll probably bring that in by the truckload. We'd like to see what effect that'll have on the pipe, too."

A new pipeline laying technique along with several novel innovations was used on this job. Employing the inert gas, consumable electrode method with a Linde welding machine, Alcoa performed all the welding at one end of the line. Then, as each joint was completed, the pipeline was pulled along the right of way by a bulldozer until the next joint was in position for joining. The pipeline was dragged over ground that ranged between 800 and 1500 ft in altitude.

Objective of this weld and drag method was to save the contractor—H. B. Ranier of Prestonburg, Ky., in this case—the trouble and cost of stringing pipe along the ROW. The entire line was welded in this manner with the welding rig being moved only once; from the top of one hill to the top of another.

Use of 6061-T6 alloy aluminum pipe made this weld and drag method possible due to substantial reductions in the weight of the pipe. "Compared to steel," said W. W. Ferrell, United Fuel's superintendent of production, "aluminum is extremely light. A 40-ft section of 4-in. steel pipe weighs about 480 lb. The same length of aluminum pipe weighs 96 lb." Alcoa's Unistrength pipe, which is designed with standard pipe wall thickness at the ends and thin walls for the rest of the pipe length, was used.

The ratio of thick to thin walls was selected to provide uniform bursting, tensile and bending strength along the pipe's length after welding. The line will have an operating pressure of 500 psig and was tested at 1500 psig. Standard wall thickness at the pipe ends also permits use of standard aluminum fittings and flanges. At the pipe ends, the wall thickness was .237-in. The remainder was .150-in. The OD at the ends was 4.5 in., and the remainder was 4.326 in.

The line was installed without coating or wrapping and was protected only by anodes. Anode tabs were 1-in. x 1-in. x .250-in. alloy 6061-T6 angles welded to the pipe. Aluminum bolt, washer, and nut secured neoprene covered No. 8 aluminum anode lead wire. Anode leads were attached every 250 ft and a 17-lb "Galvomag" anode was installed about every 500 ft; 10 ft from the pipe and at the same depth of the pipe.

While spending a couple of days at the site of this installation, GAS Magazine invited Alcoa's Gene Carlisle, development engineer, and George Fetherston, field salesman, to sit in on a question-and-answer session. Also invited were United's Hannah and Lambert and Alcoa's Frank Chamberlain, industrial sales department. The purpose of the session was to get some of the background, development, corrosion aspects, market research, etc., regarding the use of

At left is 4-in. OD line welded and in the ditch. The two sections of pipe on the right each contain up to 9 40-ft joints. One will be dragged along ROW until its end reaches the head end of the line on the left. The two will be welded, which, in effect, will add a 360-ft joint to the line.

In pulling multi-jointed sections of pipe along ROW, they must be guided. One of the guiding methods used at Phelps was merely to drive a branch into the ground, drop a small piece of pipe over it, and then use it to guide the long section around a curve in the ROW.

Improvization was common on the Phelps job. Here, an old tire casing is used to guide the pipe as it is pulled down the ROW.

Once in the ditch, the aluminum pipe line was merely weighted down with sandbags to hold it in place prior to backfilling.

LEFT: A specially trained welder (center) uses automatic welding machine to join a couple of 40-ft aluminum joints. This machine has a special back-up tool that aligns the pipe. ABOVE: George Fetherston proves the lightness of aluminum pipe by carrying a 40-ft joint to the stationary welding machine.

aluminum pipe in the natural gas industry in general and at Phelps, Ky., in particular. That interview went as follows:

Q. What made the aluminum industry interested in the gas pipeline market?

A. (Fetherston) The gas and oil industries must buy 75 to 80 per cent of all the tubular goods produced in the U. S. today. (Ed.—11,700 miles of gas pipeline and 5300 miles of oil pipeline were constructed in the U. S. in 1960.) If we (Alcoa) could get one or two per cent of this, you can see why we'd be interested. We think there's a place for aluminum in the pipeline business.

Q. Are you thinking in terms of the entire gas pipeline market?

A. (Carlisle) We're probably thinking in the smaller sizes—the 4-in., 6-in. and 8-in. OD pipelines. Here, we could come in with a wall thickness the same as or frequently less than steel. For instance, 4-in. steel pipe is rarely manufactured in less than a .188-in. wall thickness because under that it's harder to bend and becomes much more susceptible to corrosion. It doesn't take much corrosion to get through a .188-in. wall. I think that with aluminum, we can probably talk about a lower wall thickness than in steel. With anodes on the line providing good protection against soil corrosion, I think that on 4-in. pipe we can talk about a lighter wall than they normally use in steel.

Q. Why do you feel you are limited to sizes 8-in. OD and below?

A. (Carlisle) We don't feel we're limited. But, we do feel that below that size we compete a lot better. This is due to a number of things such as, for instance, the fact that we're not set up yet to extrude pipe in the larger ODs. But, we feel this is merely a supply and demand matter.

Q. Could aluminum pipe cost less than steel?

A. (Carlisle) Conceivably, yes. In aluminum we start with a pig that is about three times the price in volume than a piece of pig iron costs. But, when we're talking about these 4-in. and 6-in. lines where we don't need a wall thickness equal to that of steel; where we don't have to coat the pipe; savings realized here can make aluminum very definitely cheaper than steel. Also, remember this: A pound of aluminum sells for about $.24 and a pound of steel sells for about $.08 fabricated. But, a pound of aluminum has three times the volume of metal as does a pound of steel. So, the pig aluminum per cubic inch is costing about as much as fabricated steel. Still, the big thing is to get our production up to get costs down.

Q. You said you don't have to coat the pipe. Is that right?

A. (Carlisle) We don't think we do. We think that with anodes we can get good protection. Now, when you start making a general statement like that, somebody's going to come up and step on you. But technically, our experience is that we get darn good protection with anodes. We also have a lot of experience with a lot of aluminum in a lot of soil with no anodes. However, anodes don't cost much so it just isn't very practical to think in terms of not putting them in because you don't save that much money.

Q. This line has a maximum yield strength of 35,000 psi. Is this tops for your alloys right now?

A. (Chamberlain) This is the strongest pipe alloy we have to offer today. We have others that we're working on in the labs, some of which are very close to being made available to the market.

Q. The natural gas industry is looking for pipeline up to and possibly surpassing yield strengths of 90,000 psi. Are you working on anything even approaching this?

A. (Carlisle) We're always trying to develop stronger alloys. We don't have anything near that now. But, you've got to remember this: You're talking of strength in terms of units of strength per square inch of area. This is just one way of measuring it. The other way—and the way we like to talk about it—is in units of strength per pound. Aluminum is stronger than any steel when you measure in these terms. You can draw a comparison from the airplane industry where it is interested in getting the maximum strength per pound.

Q. Is there a market for aluminum pipe in gas distribution systems?

A. (Fetherston) We don't think so yet. In those cases you get mixed up with all kinds of copper, steel, cast iron, and stray currents. The minute you get hooked up with them, the cathodic protection for them would be supplied, because of galvanic relationship, by the aluminum pipe. If this line were in a distribution system, we'd probably end up with a 5700-ft anode.

Q. What has taken you so long to get seriously interested in the gas pipeline market?

A. (Carlisle) That's just a matter of our industry developing. The aluminum industry is suffering from over capacity in hard goods. We are looking for large volume, large tonnage markets. We have installed quite a few experimental pipelines both for ourselves and for customers, too. This is the first one that has ever been installed in terrain that even resembles this.

Q. Is the terrain the big feature here?

A. (Carlisle) That is the point that definitely separates this from any other we've ever done. Most of the previous ones have been put in areas similar to that of the Gulf Coast.

Q. What are the advantages of aluminum pipe with regard to corrosion control?

A. (Carlisle) We think we can bury this pipe without any coating on it. That thought is based upon our experience and that of others. There has been much data recorded in reports and papers to that extent.

Soil corrosion is very complicated and what you learn in Louisiana won't have a thing to do with what's going on in eastern Kentucky. This line is buried about 18 in. deep and though uncoated, has galvanic anodes on it, the spacing of which has been determined by a soil survey.

Q. Would the spacing of these anodes be the same if a steel line was going in here?

A. (Lambert) If we put a steel line in here, we would have anodes in about every 50 ft. With this line, we'll have an anode in about every 400 or 500 ft.

Q. Is the cathodic protection installed here on the premise that this being a gathering line, relatively short-term protection will be needed?

A. (Lambert) No. We want to find out how much protection we'll have to add to this pipeline to bring up the potentials to a point where it would last forever. These are brown shale wells in this area with a long-life expectancy. Some of them have lasted 45-50 years.

Q. Is it true that sulfur in this area will be hard on aluminum?

A. (Fetherston) No. Sulfuric acid is an electrolyte. In a case where you have drainage from coal seams, such as you have here, you'll also have a certain amount of sulfuric acid in the water. This provides a good environment for galvanic attack. But, this is a cathodic protection problem more than a straight chemical problem. If you're concerned about hydrogen sulfide, which is found in natural gas, this has absolutely no action or effect on aluminum. Handling sour gas is an excellent application for aluminum pipe. And gas with high concentrations of carbon dioxide—which is troublesome to steel—is another excellent application.

Q. What external corrosion effects will salt marsh have on aluminum pipe?

A. (Carlisle) We put a line in at Cameron, La., which is 100 per cent in salt marsh. That line is uncoated, too. Salt is not troublesome for aluminum either. Get a salty soil and you'll usually find soil with low resistivity.

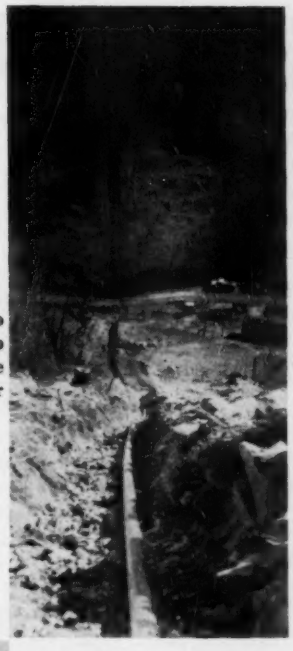
Q. What are the resistivity characteristics of the Phelps area?

A. (Lambert) We have a wide variation of soil here. It goes from somewhere around 250,000 ohm-centimeters on down to 20,000.

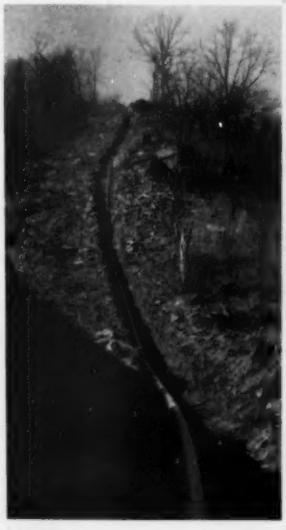
Q. How did you get your resistivity measurements?

A. (Carlisle) We walked the ROW and took resistivity measurements and plotted them, which gave us a curve showing how the resistivity of the soil varies in accordance with the distance. We found indications of a couple of "hot spots" in there. One was areas of low resistivity, which of course, can mean low resistance to current flow. The other was a sudden change in resistivity. This could lead to an anode-cathode relationship occurring.

On the basis of this survey, we picked 13 locations—which was strictly a judgment deal—where we thought we ought to put anodes. This was done using just about the same rule for judgment as you'd use for steel pipe. Then the anodes were installed but not connected to the pipe. We're going to allow a month or two for everything to settle down and then we're going to make a potential survey with reference to a copper-copper sulfate electrode (or some other standard electrode). Then we'll have plot of the potential of the line to compare with the resistivity curves to see if we have got the anodes in at the right places.



Looking down the ROW into the valley shows the sharp incline to the valley and the ROW going up the other side.



A view up the ROW showing the aluminum pipe in the ditch. This shot was taken halfway down the mountainside, about 400 ft from the crest.

Q. What kind of gains are you seeking?

A. (Carlisle) What we want to do is to bring the potential up, particularly in the areas where we ex-

pect corrosion; how far will depend on what it is when we measure it. Something like a .05-volt rise. This is something we just don't know now. There will be a practical limitation. Let's say that we do decide that we'd like to bring it up .05 of a volt. If we keep hanging anodes on there and we can't get it up, well, we'll just have to be content with something less.

In our experience in Gulf Coast soils, we have found that we ought to have a potential of about minus .9 of a volt in order to get protection and that we ought to stay below 1.2 to avoid getting over protection. That's in soil with a resistivity of about 500-ohm centimeters.

Q. Do you think you'll realize this .9 measurement?

A. (Carlisle) We'll start out aiming for .9 but everybody realizes we're dreaming. We'll never get up to that because you'd just have one continuous row of anode holes. At least this is our suspicion. We suspect that we're just going to have to be satisfied with just getting an increase. Most corrosion engineers figure if they can raise the potential, the line is protected. I can't think of any reason why that won't be good enough for the aluminum pipe, too.

Q. Are welding practices on aluminum pipe generally the same as they would be on steel pipe?

A. (Carlisle) On aluminum pipe, all the operations —stringing, hot pass, firing line—are done in one operation. As you know, with steel they have different welders putting in different beads along the spread. On aluminum pipe, one man with one machine starts a weld and doesn't turn the machine off until he completes the weld. It's made in multiple passes around the pipe.

Q. Is this process then faster than conventional welding practices?

A. (Carlisle) With this machine, we are making welds on the 4-in. pipe in about one minute. It would take one man about 15 minutes to make all the passes necessary on a steel pipe.

Q. Do welders working on aluminum pipe need any special or additional training?

A. (Carlisle) Oh yes. Welding aluminum isn't any more difficult than welding steel, but it's different. Practically all welding of aluminum that's done today is done with inert gas. That is, we flood the arc with argon, or, in some cases, a mixture of argon and helium. This prevents oxidation of the surface of the molten pool. This was a big development in the welding of aluminum. We used to use fluxes as they're used in welding steel. But, these fluxes were corrosive and also lowered the surface tension length of the molten pool to such an extent that it was almost impossible to weld overhead. You just couldn't get it to stay out.

Now there are two basic processes. One is the tungsten arc process where you have the tungsten electrode carry the arc to the work to heat the metal. Then you manually add filler wire. The other process is the one we're using with this automatic pipe welder. It's a consumable electrode process where the electrode is the filler metal. It is driven by a motor which drives the filler metal down through the torch and it's much faster. And because it's much faster, it makes stronger welds.

But, this isn't something you have to have a PhD to be able to do. A good steel welder can learn it in two or three days. But, he can't go out and just pick up a torch and weld aluminum just like he couldn't go out and pick up a torch and weld steel. He had to learn how.

Q. I notice you've been weaving this pipe through old tire casings, wrapping it around stakes in the ground, literally threading it into the ditch. How is this possible?

A. (Carlisle) Aluminum has a modulous of elasticity of 10 million psi where the figure for steel is 30 million psi. This means we can make a lot of bends elastically in aluminum pipe and we will have no permanent deformations. We make the pipe fit the ditch. At one time, we had it hanging all over the ROW there like a big, long piece of spaghetti. The contractor couldn't get over it.

Q. Does Alcoa have anything in its plans for a field fabricating machine for aluminum pipe such as the Driam machine for steel pipe?

A. (Carlisle) That's under active consideration. But that would be a welded pipe where now our pipe is extruded.

Q. Due to the fact that it is extruded, what effect does this have on pressure drops due to internal flow resistance?

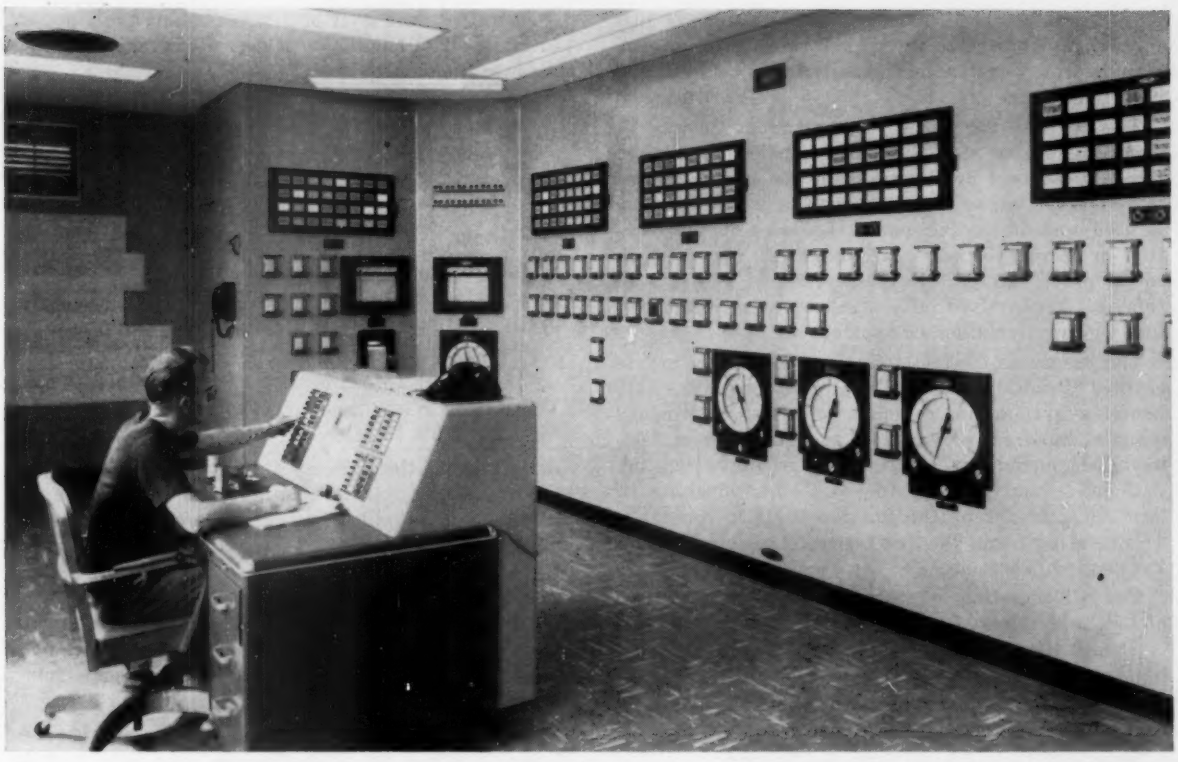
A. (Carlisle) Aluminum pipe is a very smooth material just as is drawn brass, glass, transite, stainless steel or plastic. It's quite a bit smoother than commercial steel pipe. But, pressure drops depend upon the kind of flow you have—whether it be turbulent or viscous. On this particular line it doesn't make much difference. In certain cases it could very definitely be important. Some companies use aluminum pipe instead of steel for handling crude oil because they don't get as much paraffin build-up.

Q. What kind of casing are you using on this line?

A. (Lambert) We're using 8-in. OD aluminum casing. We aren't going to take any particular precautions to insulate it. We don't feel we have to. We're just going to use spacers in there. Standard steel casing could be used, but it would require heavy insulation. Incidentally, insulating flanges are used to cathodically protect the pipe at the wellhead tie-in.

Q. What are the atmospheric temperature limitations affecting aluminum pipe?

A. (Fetherston) You'd have to pre-heat for aluminum at just about the same temperatures you'd have to pre-heat for steel. However, aluminum does not get brittle at temperatures below zero. In ferrous metals, anything below —20 deg. F, you've got to worry about this. This is no problem with aluminum as it's non-ferrous. ■



Just what is data handling?

By F. VINTON LONG
Texas Eastern Transmission Corp.
Shreveport

ALL of us have been hearing a lot about this thing called "data handling" and almost any magazine that you pick up from *Gas* on down to "Dick Tracy" mentions it.

Maybe we should try to resolve just what is data handling.

With apologies to the AIEE telemetering committee, including W. E. Rufleth who is chairman on subcommittee on data handling, Ed Lynch, and W. F. Cruess, I will sift through some of their learned observations and will try to place this into one-syllable words for our gas handling readers.

Webster's New Collegiate Dictionary defines "data," the plural of "datum," as information, facts, memoranda. Some definitions for "handling" are "dealing with," and "the mode of treatment." In other words "data handling" may be defined as the treating or dealing with information.

Although some of us do not realize it, plain old telemetering equipment is an essential part of a data handling system.

This includes both transmitters and receivers, and includes both analog and digital systems.

As a matter of fact, most digital information starts

out from a machine in analog form, and it is just for convenience that we transform it into digital signals which can be more easily interpreted at the other end of the circuit.

The March 1959 issue of Instrument Society of America *Journal* said that data handling comprised the data obtained by measurement and it may be displayed, recorded, or transmitted to be useful. It may be used immediately for control through a human function or through other instruments. It may also be retained for reference, computations, or control. In this area are involved indication, recording, telemetering, logging, scanning, computing, etc.

The magazine *Chemical Engineering*, in an article entitled "Process Data Handling," mentions that a data handling system for a refinery involves continuous scans of hundreds of variables brought in from field-mounted transmitters, and logged hourly or on demand, with off-normal printing in red. Also, punching of tape for transfer of information to IBM computer. Telemetering forms the link between the detectors and the logging operation.

You will note that telemetering is a vital link in all of these operations.

Rufleth mentions that in the past few years many industries have begun to show great interest in remote data handling systems. And their requirements vary widely from company to company.

Several of these typical examples follow:

1. Transmission of all readings and print out either on a time basis or by manual initiation. No selection of individual readings.
2. Transmission of all readings initiated manually or by timer. Some readings displayed only, others displayed and printed. Individual readings may be transmitted upon certain deviations or when a certain rate of change takes place. In other words, a deviation detector is employed at the compressor or pump station.
3. Periodic or on demand transmission of all readings and print out. Selection at any time of any individual readings for visual display. Tape punch may be involved.
4. The remote station must automatically take all readings exactly on the hour, punch them on tape, store them, then transmit the stored data upon interrogation by the dispatch office.

Where the purpose of the data handling system is to provide permanent records for later use, the optimum end device will depend on how the record will eventually be used. Most of us tend to assume that the output device should be a typewriter; but this is not always the best answer. In general a tape punch will usually provide more usable records. The tape can be processed by the conventional IBM type machines found in most large offices. A typical procedure would be to put tape through a tape-to-card converter transferring the pertinent data to punched cards; sorting cards automatically to select desired data; and processing selected cards through conventional office machines to perform such operations as obtaining totals, averages, maximums, etc.

There has been a lot of interest among the pipelines in remote data handling systems. However, two things seem to stand out:

a) In spite of all the interest and all the discussion, relatively few systems are actually in operation.

b) Everyone seems to have a different idea of what they want in a remote data handling system.

Here are some of the widely varying basic requirements which have been tossed into the mill by prospective customers:

1. When initiated manually, or by a timer, the system need only transmit all readings and print them. There is no visual readout. There is no requirement for being able to select an individual reading.

2. When initiated manually, or by a timer, the system must transmit all readings. Some readings are to be displayed only; and others are to be both displayed and printed. Some readings must be transmitted individually when they deviate by a certain amount from the previous reading, or when they change above a certain rate, or when they deviate from a set point. Some of these must be displayed only, some must be printed in red, and some must operate an alarm.

3. Twice a day the system must transmit all readings; at other hours during the day only certain readings are to be transmitted; and during the night other readings are to be sent. Any of the above cycles can be initiated manually at any time. All of the above cycles require printing and tap punching. In addition to the above, the dispatcher must be able to manually select individual readings with visual display; and to select a group of four readings which will be automatically cycled and displayed continuously.

4. The remote station must automatically take all readings exactly on the hour, punch them on tape, store them until the next hourly reading, and transmit its stored data whenever interrogated by the dispatching office.

5. Accuracy of 0.1 per cent is essential, speed and cost being secondary.

6. Accuracy of 0.5 per cent is essential with a maximum allowable time of 0.2 seconds per reading.

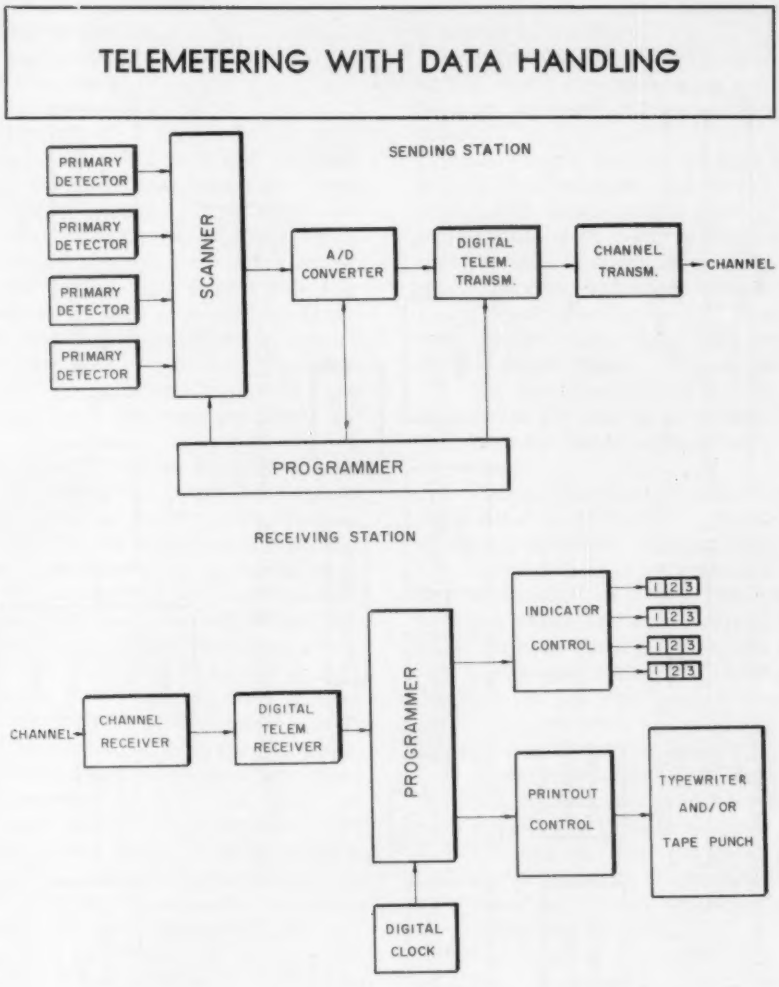
7. Accuracy of 1 per cent is good enough but high speed is essential (10 readings per second or better). Practically unlimited bandwidth is available.

8. Accuracy of 2 per cent is acceptable and speed is not important. Main requirements are moderate cost and use of narrow band channel.

9. All readings must be taken simultaneously "on the hour" and stored at the remote station until the master station is ready to print.

10. Readings should be as close to "on the hour" as possible; but this is not worth the cost of storage at the remote station. A spread of about one minute per station is satisfactory.

11. Simultaneity of readings is unimportant; and



is secondary to cost. A spread of several minutes per station and 30 minutes for the entire system is acceptable.

It is important to note that the above widely varying requirements originated from some of the largest and most respected companies in the electric utility and pipeline fields. Presumably these requirements were the result of careful study on the part of these companies.

Obviously it would be possible to design a standardized system which could meet several of the above requirements. For example, a system having 0.1 per cent accuracy could be used where accuracies of 0.5, 1, or 2 per cent are specified. However, a design having unnecessarily high accuracy and unneeded flexibility would be very expensive. It is also obvious that some of the above requirements are mutually exclusive. For example, it is possible to design for high speed or narrow bandwidth; but not both.

In this welter of conflicting requirements and ideas, we believe that most people would agree on the following fundamental facts:

1. Most quantities to be measured are in analog form; and most printers are inherently digital devices. Therefore, analog-digital conversion is required somewhere in the system.

2. It is preferable to do the analog-digital conversion at the remote station; and thus to transmit the data in digital form from the remote station to the master station. This is faster and more accurate than using analog telemetering and doing the analog-digital conversion at the master station.

3. Economics will usually dictate using a single analog-digital converter, and switching it among the various quantities to be telemetered.

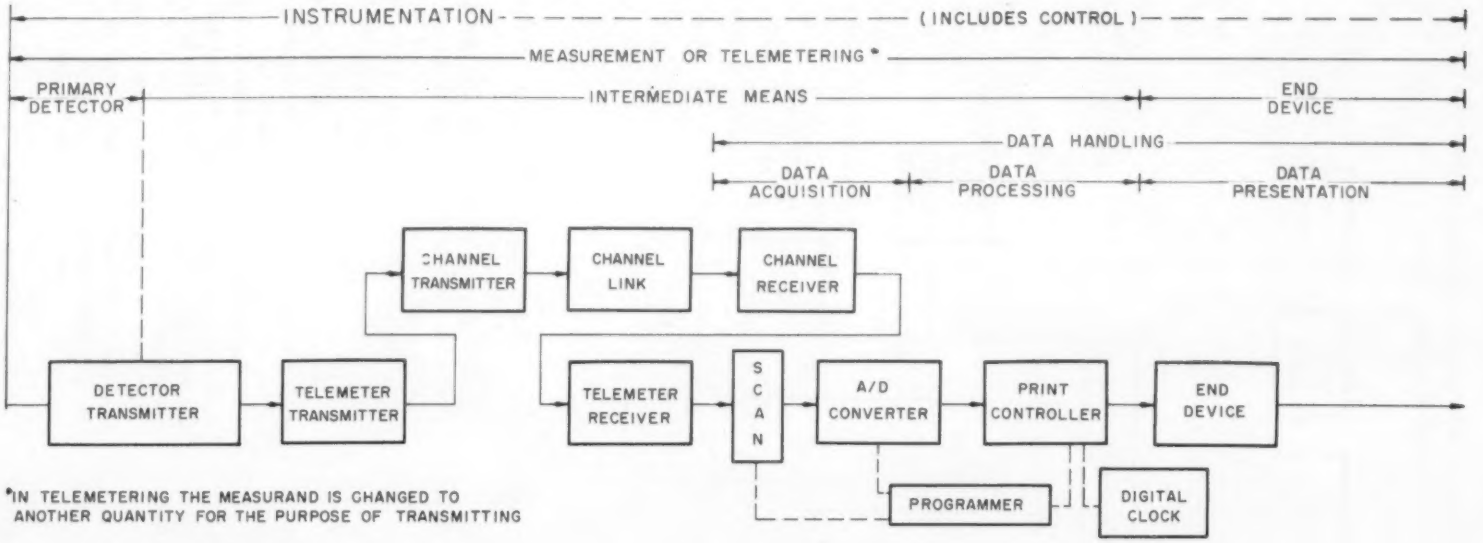
4. The digital signals sent from the remote station to the master station must be encoded to prevent channel noise from impairing the accuracy of the readings.

In view of these factors, a remote data logging and digital telemetering system may be divided into the following parts:

At The Remote Station:

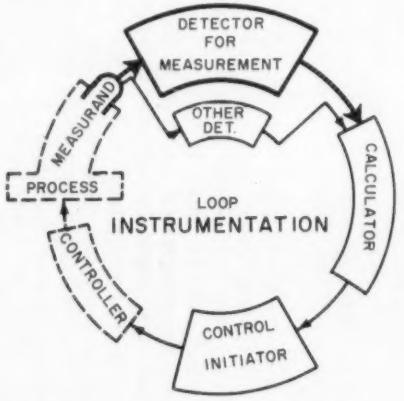
a) Transducers
b) Switching equipment
c) Analog-digital converter
d) Encoding and transmitting equipment
e) Channelizing equipment

SOME WIDELY USED INSTRUMENTATION NOMENCLATURE

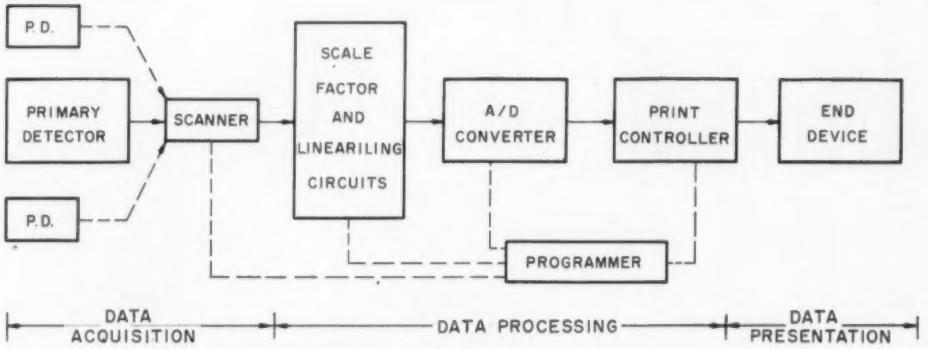


*IN TELEMETERING THE MEASURAND IS CHANGED TO ANOTHER QUANTITY FOR THE PURPOSE OF TRANSMITTING

ANALOG TRANSMISSION & DIGITAL PRESENTATION



TYPICAL PROCESS TYPE INSTRUMENTATION



LOCAL TELEMETERING FOR LOGGING SYSTEM

COURTESY MR. ED LYNCH

At The Master Station:

f) Channelizing equipment
g) Decoding equipment
h) Switching equipment
i) Visual indicators
j) Printers or punches

In general, it can be said that no single company manufactures all of the parts that comprise a complete remote data logging system. (Typewriters and tape punches are obvious examples of items which systems suppliers would procure from other manufacturers). Thus the supplier of a remote data logging system could be considered as a prime contractor. He must build some equipment himself, specify and procure other equipment from other manufacturers, combine these into an integrated system; and coordinate the system with the communications facilities.

Regarding the choice of analog or digital telemetering, it will frequently be found that digital telemetering is required to provide a satisfactory overall operating speed for the data handling system. With analog telemetering, the fastest operating speed would be obtained by telemetering all quantities continuously. This will frequently be impractical because of the prohobitive number of telemeter channels required (the fact that data handling is used would ordinarily imply that a large number of variables are involved—sometimes several hundred). If a common analog telemeter were to be used to transmit several variables sequentially, the resultant speed of the data handling system might be too slow. For example, a typical high-speed analog telemeter of the frequency type might have nominal characteristics of 1 per cent accuracy, 1 second response, and 35 cycles per second bandwidth. By sequentially switching such a telemeter, the very best speed that one could hope for would be somewhat over 1 second per reading. On the other hand, a digital telemeter employing the same channel bandwidth and having equal accuracy could easily provide two readings per second.

In planning a data handling system, a basic consideration should be the intended purpose of the system. The system might be intended to:

—Provide an operator or a computer with data on which to base minute-by-minute operating decisions.
—Provide permanent records to be used at some later time for analysis, system planning, or accounting.

For on-the-spot operating decisions, it might well be desirable to have analog outputs from the system —even though digital telemetering might be employed to obtain high accuracy and efficient utilization of the channel. Presumably the analog outputs would be maintained continuously; and would be periodically up dated by the telemetering. The analog outputs might be desirable because:

1. Human engineering studies show that some people can comprehend a reading faster on a conventional pointer-and-scale instrument than on a digital indicator.

2. In many cases, the trend of a variable is the important thing; and trends are more easily comprehended from a curve-drawing recorder than from a column of numbers.

3. In spite of the current popularity of digital computers, small, special-purpose analog computers may be more economical for specific industrial applications.

Where the purpose of the data handling system is to provide permanent records for later use, the optimum end device will depend on how the records will eventually be used. Most people tend to assume that the output device should be a typewriter; but this is not always the best answer. In general, a tape punch would usually record. The tape can be processed by the conventional IBM-type machines found in most large offices. A typical procedure would be:

1. Put the tape through a tape-to-card converter to transfer the data to punched cards.

2. Sort the cards automatically to select the desired data.

3. Process the selected cards through conventional office machines to perform arithmetic operations such as obtaining totals, averages, maximums, etc.

4. If the data is to be processed by a conventional computer (such as a 650, 704, 705, or Univac) the punched cards are a convenient form in which to have the data. In some cases the cards can be read into the computer directly. In other cases it will be desirable to put the cards through a card-to-magnetic tape converter; and to use the magnetic tape as the input to the computer.

It appears that the use of data handling on telemetering systems has brought with it new accuracy requirements for the telemetering. Heretofore a nominal accuracy of 1 per cent has been considered adequate for telemetering. However, many current remote data handling systems are being specified and built for 0.1 per cent accuracy.

There seems to be a great lack of mutual understanding among manufacturers and prospective users as to what these data handling systems can do and how they should be built. This is evidenced by the broad spread of bids quoted by manufacturers. When several reputable manufacturers, all bidding on the same purchaser's specification, quote prices that frequently range from 2 to 3 to 1; and sometimes reach 5 or 6 to 1, it appears that something is wrong. When a prospective user receives such a wide range of bids it is understandable if be becomes confused and wonders if any of the manufacturers know what they are talking about.

This does not appear to be simply a situation where certain manufacturers have equipment or methods which are substantially less expensive and thus these same manufacturers are always low bidders. Some of it is undoubtedly the result of various manufacturers trying to "buy" a first installation in a new field. However, it is felt that the main cause of this situation is a lack of common understanding of data handling systems. The intent of this comment is not to pinpoint a definite cause nor propose a definite solution; but simply to point out that the situation exists and should be recognized.

I think what I am trying to say by these quotations from known experts is that you cannot get away from telemetering in any aspect of data handling. ■

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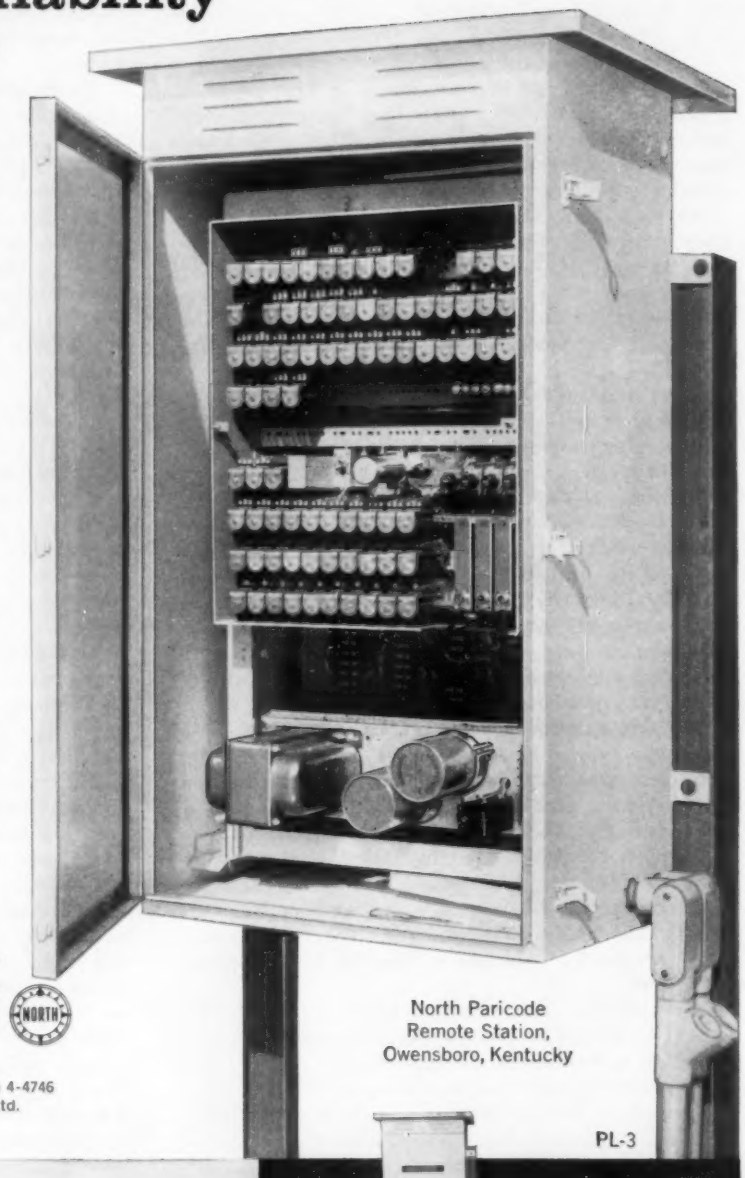

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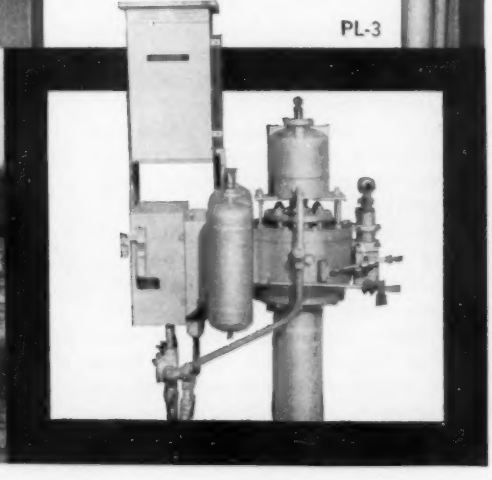

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Edited by FRANK CHAPMAN

Channels for data transmission

By F. VINTON LONG

WE have heard so much about data transmission that maybe we will try to explain a little bit about the channel space that is required for it. The requirements for transmission will be the same whether it is for private microwave systems or for leased wire facilities from the common carriers. However, there is a fundamental and great difference in the nature of voice signals compared to data signals.

And there are two fundamentally different kinds of signals transmitted over communication networks. The first is used for voice conversation and radio and television programs. These signals are presently transmitted as continuously variable electrical waves where either the strength or the frequency of the electrical wave represents the original sound wave or light pattern. They are called "analog" signals.

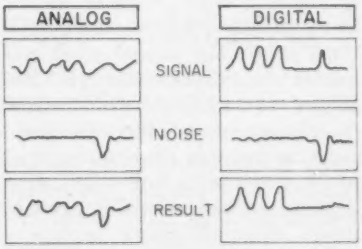
The second type—the older of the two—is used for telegraph and teletypewriter service. Here the signals represent distinct, discontinous characters (like the letters of the alphabet) and the electrical signals are in one of two states—"on or off". For example, in the teletypewriter code each character is represented by a group of five adjacent pulse positions. Each of these either contains or doesn't contain a pulse, according to the character being transmitted. Since the pulses themselves are all alike, the signalling is based on a pattern of pulses and spaces. This type of signal is called "digital."

A common method of data transmission uses binary signals. Here every digit—every bit of information—can be only one of two possible things: "on" or "off," "yes" or "no," "0" or "1." A character sent over this system is represented by a group of binary digits or "bits." Thus a change in one digit will change the character, which in the case of numbers may change the meaning of the message. This has brought into use a number of error checking devices to verify the received data.

A common error checking scheme is the "parity check" system which makes the digital system redundant by adding extra pluses ("added on" bits) to make each character add up to an odd number. Pulses are then counted by the receiving device on a character-by-character basis. Any character containing an even number of pulses is erroneous.

It will be noted that the telegraph grade data channels of head lines are classified in accordance with the line signalling speed of 60, 75, and 100 wpm teletypewriter services.

These accommodate a certain number of bits per second. Bit, sometimes called Baud, is a term meaning unit signal element, or pulse, thus the bit rate is the pulse rate. It is actually two times (2X) the cycles-per-second (frequency) rate. The digital type of signal being of square wave "on-off" construction is far less economical in the band pass requirements than the ac or sine wave of the analog signal. This explains why the bit rate of 1000 bits-per-second (BPS) or the equivalent of 500 cycles is the maximum recommended signalling rate over a voice channel that is normally satisfactory for up to 3000 cycles of analog type signal transmission.



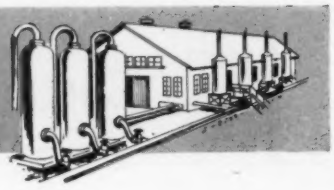
Comparison of effect of noise pulse on both analog and digital signals. When added to the analog signal, the noise pulse results in merely a faint tick. When added to the digital signal, however, the noise shown here turns a pulse into a non-pulse.

I believe the diagram explains why transmittal of digital type information is much more exacting than that of analog and very much more exacting than the analog transmission commonly known as "the voice." The voice is quite easy to transmit because of an inherent redundancy in intelligence, so that you can miss quite a bit about what a man says and still manage to make out what he means. However, that just doesn't go for digital transmission.

An example of this is a Western Union "radio beam" system now being installed from coast to coast. This system will transmit television signals, but will at first change them into digital information. This makes the requirement much tougher for technical performance of the microwave system. However, if you can send digital information without garbling, it is bound to be right on the nose as far as accuracy is concerned.

I am indebted for this information to the Long Line division of our largest common carrier which has been cooperating with many of us in providing the best possible channels indicated for our requirements. ■

GAS PIPELINE NEWS



Enchilada Inch hearings held

By J. FRED EBDON

WHILE January winds were anything but sharp in the Los Angeles area of southern California, there was considerable breeze stirred up in Police Headquarters of that city as Enchilada Inch hearings got underway. (See GAS January and February.)

The monumental proceedings started Jan. 25, 26, and 27. We suspect we will be using another calendar when the overall issue is decided.

Bright and early on Jan. 25 we slipped into our highly styled plastic $4-raincoat and slushed down to Los Angeles' new State Building. It was raining in the City of Angels.

At a room in which California's Public Utilities Commission appointed the session, we found a multitude of lawyers. Others were there too; however, the attorney herd particularly impressed us. We judge the lawyer-count would approximate that expected at a wreck in which three ambulances came together.

PUC President Everett C. McKeage just gaveled the session into life long enough to announce the room was inadequate and tell us where to reconvene. There followed an en masse "parade of the bulging briefcases" to Los Angeles' very striking new Police Building. It was rumored that a few fellows faded into the sprinkle on learning the destination. However, we were unable to support this allegation with fact.

Thus, in the Los Angeles Police Department's auditorium, President McKeage and William W. Dunlop, examiner, got the hearing down to cases.

McKeage informed that the application at hand was No. 42931. This one involved California Gas Transmission Co. (a TGT subsidiary) and its quest for a certificate of public convenience and necessity to build that part of the Texas-Mexico-California pipeline—known to all except the Applicants and Protestants as the "Enchilada Inch"—which it proposes to install between the California-Mexico international boundary and assorted southern California Edison Co. kilowatt-creators in the Los Angeles basin.

His Honor then made it clear he was hearing Application 42931, but the commission might later consolidate Application No. 42???, SoCalEd's hearing. We didn't get that "license number" as our trusty pencil broke. However, he would hear Edison's direct evidence in support of No. 42931, and its words on its own application, and then they may be consolidated, later; or if they aren't, they could be, providing they should be, or something. In any case, we trust legal minds present picked up the intent. Our pencil was still pointless.

President McKeage then launched a small torpedo at the stern of the ship of public relations effort. My unlegal mind was unable to break through this thicket, and I had not found a pencil sharpener, so this one went right by me, too. Even a lawyer or two couldn't seem to net this shot. And we noticed several gaggles of public relations people reverently lifting their eyes toward Madison Ave. for guidance and clarification. The president didn't want a pseudo-specific type of public relations intelligence circulated. However, this far from stopcocked PR-type paper. The public relations men just took a hitch in their grey flannels and pumped out a pretty steady stream of releases, preprinted testimony, statements, etc.

We think this is as it should be. A public hearing should be a public hearing. As for a trial in the newspapers, we say there might as well be one on this case because the newspapers try just about everything and everyone else. And, in the doing, the newspaper boys pep such things up quite a bit, too.

Opening statements were the next order of business. These were made by California Gas Transmission Co., applicant; Southern California Edison Co., interested party; Transwestern Pipeline Co., protestant; El Paso Natural Gas Co., protestant; California Manufacturers Association, interested party; Humble Oil & Refining Co., interested party; Pacific Lighting Corp. companies, protestants; Los Angeles County Air Pollution Control District (APCD), interested party; and several others.

Other groups present as interested parties: Standard Oil Co. of California, City of Burbank, Los Angeles Department of Water & Power, City of Los Angeles, San Diego Gas & Electric Co., Pacific Gas & Electric Co., California Electric Power Co., Monolith Portland Cement Co., Imperial Irrigation District, California Department of Water Resources, Public Service Department of the City of Burbank, City of Pasadena, California Farm Bureau Federation, City of Long Beach, City of Glendale, and some others.

Opening statements pretty well stated positions of the various companies and organizations. Two surprises turned up, resulting in rather curious events. First, S.

(*Continued on page* 154)

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Enchilada Inch

(*Continued from page* 150)

Smith Griswold, Air Pollution Control Officer, Los Angeles County, sprung a resolution from the Board of Supervisors of Los Angeles County. In effect he said: We urge Cal-PUC to approve California Gas Transmission and Southern California Edison plans, in order to minimize air pollution problems.

In newspapers the next day (Jan. 26), it became very evident that the Board of Supervisors for the County had merely passed a resolution someone put before them. One or more hadn't even read the resolution; others didn't understand what was involved. Obviously, the thing had been passed much as a resolution to proclaim "Lettuce Pickers' Week" usually is. We did not see any more of Mr. Griswold. We do expect him later.

A representation of California Manufacturers Association made an appearance to say that organization was dead against the Enchilada Inch project. Several observers later noticed a fellow calling each member of the organization, one after the other from a list, using a phone in the Police Department building lobby. The next day, California Manufacturers Association received permission to withdraw its resolution against Enchilada Inch. A spokesman said it then took a neutral position, but: "We are expecting applicants to prove that public convenience and necessity require this project."

Direct evidence followed. It is impossible to report all of it in detail as the stack of prepared direct sits over a foot tall on our desk. However, here are some of the important points developed:

CGT representatives predicted, and gave evidence of, a continuing tremendous rate of growth in southern California for natural gas requirements on both a long-term and short-term basis. The present reserves from which supply is obtained for the state do not have additional potential for present California suppliers, in competition with gas pipelines supplying other areas, to assure that southern California's future requirements can be met, contended CGT. Further, PG&E seems to have reached the same conclusion and is going to Canada for gas. Also, El Paso Natural is reaching out to both the Rocky Mountain and Gulf Coast areas for additional gas—which, said Cal Gas, pretty well proves up its point.

CGT witnesses explained there is more gas available from Texas' Gulf coast than anywhere else in the U. S., although competition for it is severe. In northern Mexico, however, there is less internal pressure and demand on presently proved reserves. And CGT sees excellent potential for the Reynosa fields and other areas through which Enchilada Inch proposes to construct.

Three unique aspects of the project came to attention from California Gas Transmission. First: a preferred position in competing for gas supplies in northern Mexico where huge gas reserve potentials are said to exist. Second, a fixed and determinable gas price for a period of 20 years. And, third, the importance of the project relative to U. S. relations with Mexico, and all Latin America, in view of the present posture of world affairs.

Witnesses for Southern California Edison backed the California Gas Transmission case. In addition, their views that electric customers (Edison serves 5 million electric users) in California are entitled to as much consideration as gas consumers. And none of SoCalEd's customers has interruptible power service.

Because Pacific Lighting Corp. gas companies must interrupt gas supply to Edison's thermal-generators, from time to time, Edison has to contract for fuel oil to have a supply of that fuel available.

Two facts are plain, Edison said. First, the population growth in its service area has been explosive and, in immediate years to come, additional generating capacity must use thermal energy. Thus, with this mounting dependence on steam-electric generators, an adequate fuel supply for them becomes ever-more important.

Second, the air pollution problem in southern California has been superimposed upon the load growth problem. Authorities have urged burning natural gas under steam generators in thermal - electric plants. And Edison contends the Pacific Lighting gas companies have never been willing to enter long-term (20 years or more) commitments to provide assured annual quantities of gas in any volumes.

Edison now uses tremendous volumes of oil and gas to generate its power, and future growth dwarfs current requirements. Hence, it says it has to know how much natural gas it can be assured in specific periods so that it can contract intelligently for replacement fuel oil in a fluctuating fuel-oil market.

The electric utility knows it will have to build new thermal-generators to meet its electric utility obligations. These must have useful lives in excess of 25 years. And it must have some kind of fuel supply for them.

A big point in SoCalEd's arguments is that natural gas is the only prime energy supply they can buy over a long term with any assurance that the supply can be used in its plants. When atomic energy gets here economically, there will be a different story. But, it isn't here yet, by a long shot.

Exhibits introduced along the way brought out that Southern California Edison and Humble Oil & Refining Co. have executed gas purchase contracts under which Humble will sell Edison:

(1) up to 250 MMcfd, to be delivered at the tailgate of Humble's King Ranch processing plant, Kleberg county, Texas;

(2) up to 12 MMcfd from the Calandria field, Kenedy county, Texas;

(3) up to 14 MMcfd from Willimar and Willimar Southwest fields, Willacy, Texas;

(4) up to 3 MMcfd from the East Three Islands field, Cameron county, Texas;

(5) up to 15 MMcfd from La-Coma, Sal Del Rey and Sal De Rey West fields, Hidalgo county, Texas.

Said contracts are for 20 years. Edison has to take or pay for specific volumes under each, but has a year to make up gas paid for but not taken. Daily volumes build up each year until the mentioned volumes are reached in the fifth

(*Continued on page* 157)

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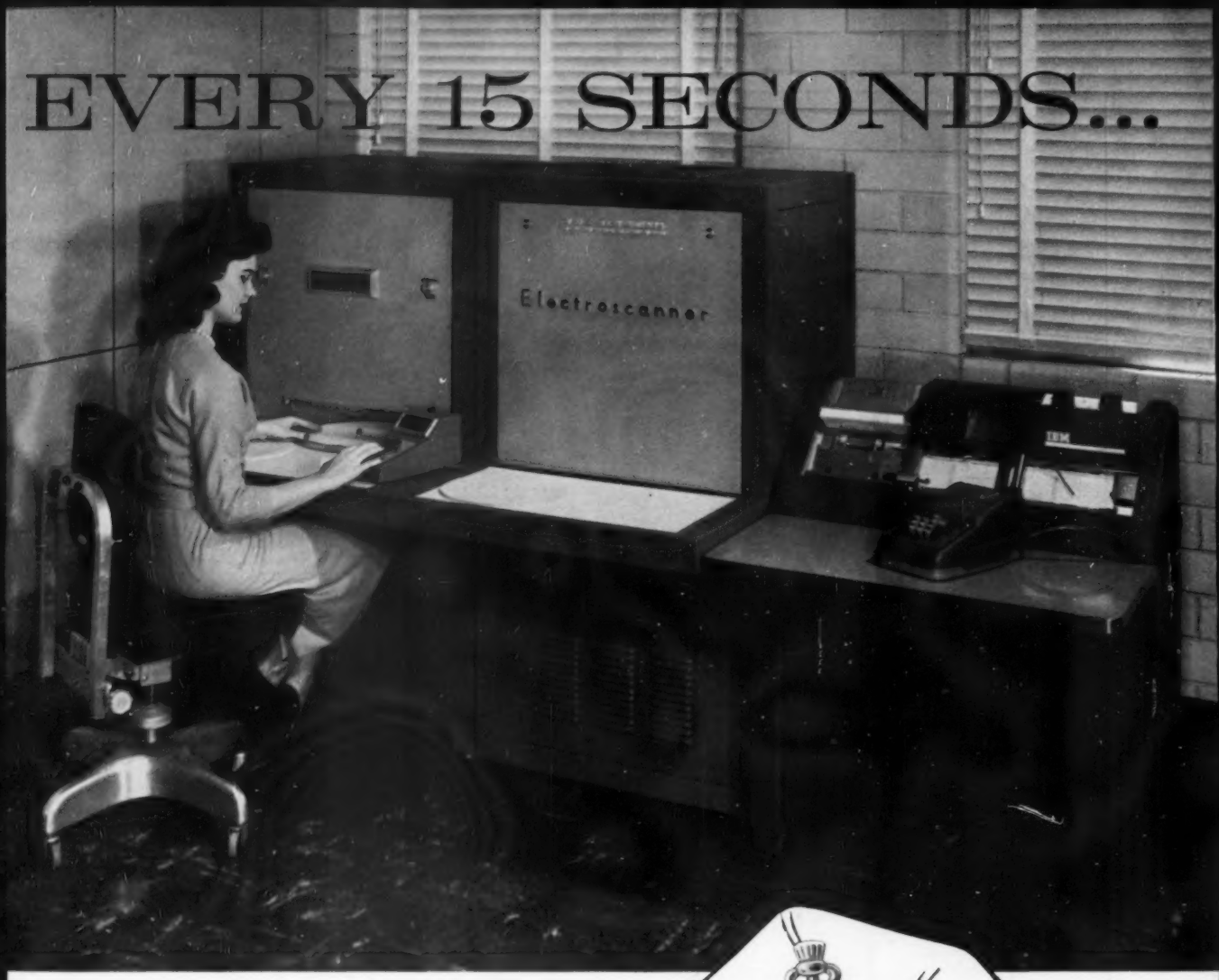

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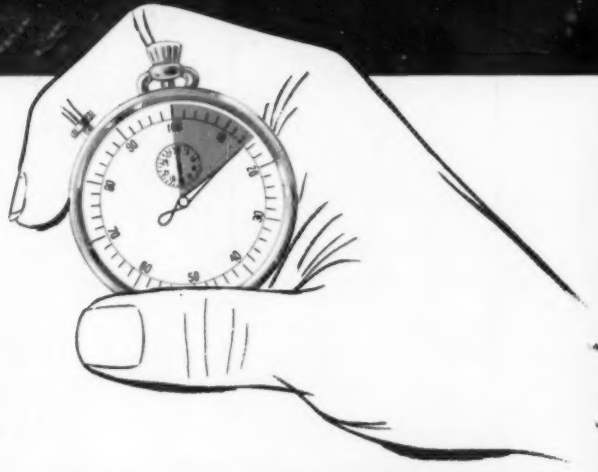

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Enchilada Inch

Continued from page 154

year. They remain constant for the rest of the 20-year period. Edison is obligated to use the Humble gas for fuel; it cannot be resold.

There are no favored nations, spiral escalation or price redetermination clauses. There is, however, a price adjustment clause based on variations in the U. S. Bureau of Labor Statistics' "Wholesale Price Index—All Commodities."

The King Ranch contract is the big gun in the group. It starts at 102 MMcfd during the first year and builds up to 250 MMcfd in the fifth, and thereafter. Humble has to make the maximum daily contract volume available for the entire 20-year period, regardless of the reserves' ability to deliver. By separate letter of agreement, Humble has assured Edison that if reserves under the other four contracts (excepting the King Ranch contract) do not hit the aggregate 352 billion cu ft contemplated, then Humble will provide reserves deficiencies from other reserves.

An agreement between Tennessee Gas Transmission Co. and Petroleos Mexicanos, dated June 8, 1960, was submitted. This covers design, construction, maintenance, and technical supervision by subsidiaries of TGT for Pemex of the in-Mexico segment of the Enchilada Inch. This letter sets forth various advantages to the Mexican nation, such as:

1. Use of Mexican labor, pipe and other material as much as possible.

2. Purchase of Mexican-produced gas—a minimum of 75 MMcfd for 20 years.

3. Making natural gas available in northern Mexico areas currently not within economic reach of gas reserves.

4. Opening market possibilities to potential Pemex gas reserves that might be developed along the proposed pipeline's route.

5. Ownership by Pemex of the pipeline 20 years after the facility is placed in service.

Base price to be paid for Pemex gas will be 17.20 cents per Mcf. Price variation is provided in the Letter Agreement by a clause that sets changes in relation to ". . . variations which have occurred in comparable costs (the index from which such variations shall be determined is to be agreed upon) . . ." A price variation provision to take into account fluctuations in heating value per unit volume is also included.

If additional (to the base 75 MMcfd minimum) gas is purchased from Pemex, this price schedule is provided for each 25 MMcfd additional, or part thereof: 17.45 cents per Mcf; 17.70 cents per Mcf; 17.95 cents per Mcf; 18.20 cents per Mcf; and 18.45 cents per Mcf.

In a Dec. 1, 1960 letter agreement between TGT and SoCalEd, Tennessee assured Edison that the price of Enchilada Inch gas to Edison will not exceed an overall average of 45 cents per Mcf delivered, for the full 20 years, based on a 100-per cent load factor. In a contract to be inked prior to Feb. 15, 1961, according to the agreement, TGT will assure Edison that TGT will guarantee the 45-cent-per-Mcf average cost, or if it is exceeded, will reimburse Edison or reduce the cost to make the price average to the 45-cent figure. Edison also is given an option to purchase 40 per cent of the equity interest in California Gas Transmission (CalGas) with each having a first refusal on any sale by the other.

Along with other letter agreements, such as one between SoCal-Ed and TGT's Mexican subsidiary PISA, CalGas introduced extensive direct evidence and exhibits to show economic feasibility, adequate present and future market, engineering design, location of facilities, capital cost estimate, etc., for the project. The contract between Southern California Edison and California Gas Transmission covering the transportation agreement, under which CalGas will move the energy from the Mexican border to SoCalEd's steam plants, also was placed on the record.

A lot of interest, and we suspect hope, was centered on a study by Stanford Research Institute titled "Thermal Energy Requirements in Southern California." CalGas underwrote the cost of this study and placed it in its case. The report showed that in the best opinion of SRI:

1. Southern California markets for fuel can absorb all additional gas from both the Rock Springs and Enchilada Inch projects.

2. Existing out-of-state gas supplies and the new gas supplies proposed can be purchased on an at-least 90-per cent annual load factor basis, under normal southern California weather conditions.

3. The proposed CalGas project will not disrupt the two-fuel economy now existing in southern California.

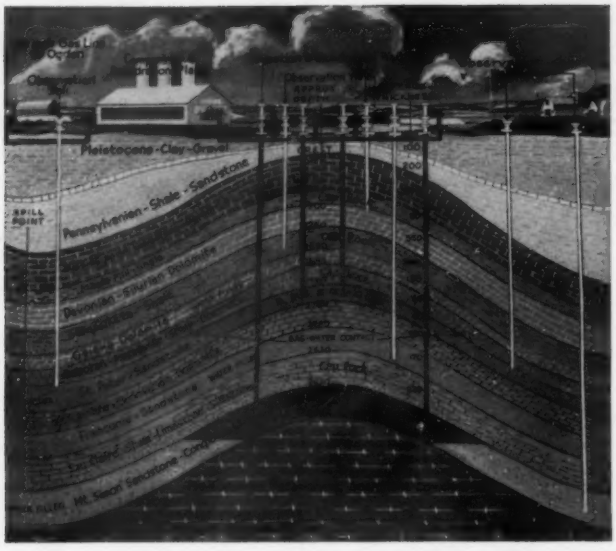
4. Edison's proposed independent gas supply via the Texas-Mexico-California pipeline will not materially change the currently operating gas companies' ratio of interruptible-to-firm load which has existed in the past few years.

A good bit of emphasis seemed to be placed on relationships between the government of the Republic of Mexico and its oil and gas operating unit, Petroleos Mexicanos. A Mexican lawyer, retained by TGT, asserted for the record that Pemex' director general had authority to execute the agreement (June 8, 1960) between TGT and Pemex, and that the Pemex board of directors approved the action prior thereto. It was his testimony that once the contracts contemplated in the letter agreement are executed between Pemex and TGT, no further authorization is required from the federal government of Mexico, other than minor and routine permits.

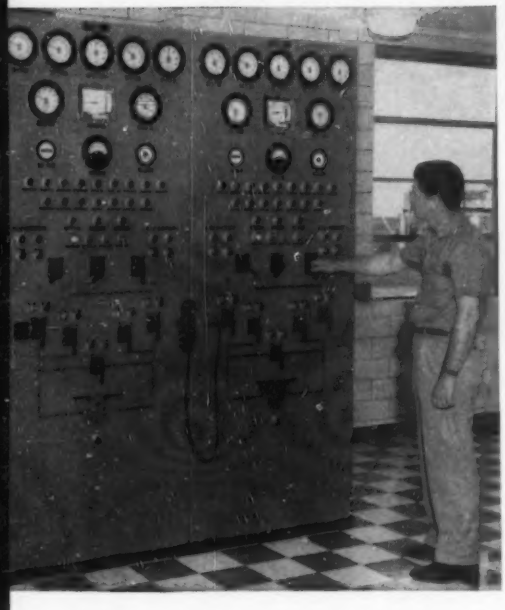
To back this up, the TGT sphere of influence arranged for two Pemex officials to fly into Los Angeles during the latter part of the hearing to give their views. These gentlemen were Rafael Ortiz Mena, general coordinator of Petroleos, Mexicanos, and Serapion Fernandez, advisor to the director general of Petroleos Mexicanos. They pretty well backed up the previous testimony that Pemex knew it had signed what it did sign.

Witnesses from Mexico did not touch on the repetitious rumors of some sort of schism between government officials of Mexico and officials of Pemex. However, since six members of the board of direc-

Continued on page 160

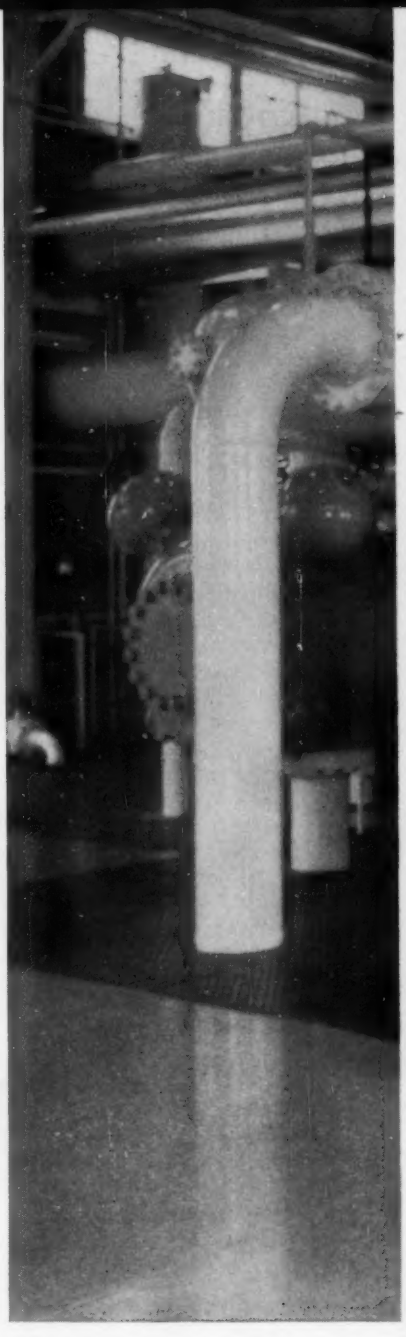


▲ Cutaway drawing of underground storage reservoir at Redfield. This station injects into St. Peter and Mt. Simon sandstone at 59 wells. Ultimate capacity of both strata is about 140 billion cu. ft.



M. H. Raven (right), Superintendent of ▶ Northern Natural Gas Company's underground storage compressor station near Redfield, Iowa, until his recent promotion, discusses the facts with H. E. Hansen, Shift Engineer. Compressor in foreground is GMWA-8, rated 2000 hp. Another similar unit is in the background.

◀ Cooper-Bessemer En-Tronic control provides complete start-stop, loading—unloading automation for the engine driven compressor.



How a rugged <u>two-cycle</u> compressor aids a variable-load gas storage program

During its first year's operation, Redfield Station of Northern Natural Gas Company has been put through a rigorous test. According to M. H. Raven, Superintendent, "Our Cooper-Bessemer GMWA-8 Compressor and En-Tronic Control have responded round-the-clock to this program of normal loading, underloading and overloading with remarkable performance. Despite abnormal loading, oil consumption and water usage have been very low. Inspection and cleaning after 12,000 hours showed all parts in perfect condition. It is a *rugged* machine!"

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Enchilada Inch

Continued from page 157

tors of Pemex are also officials of the Government of the Republic of Mexico, with rank equivalent to U. S. cabinet level, the reports of friction appear to be merely rumors with purpose.

CalGas' parade of witnesses was headed by William W. Witmer, 37-year-old senior vice president of TGT, president of CalGas and Tennessee California Gas Transmission, and president of the two TGT Mexican corporations, Propulsora Internationale, S.A. de C.V. and Supervision y Servicio, S.A. de C. V.

Friends of the gas industry, assuming there are some, will join my conclusions that one of such a rather tender age does not become a senior vice president at Tennessee Gas without ability. Witmer made this rather obvious during his direction of the TGT side of things and his deportment in the witness chair.

Asking the questions for TGT, and handler of the several incipient brush fires that developed during the hearings, was the personable Jack Werner, attorney, from Washington, D. C. We will say that Mr. Werner's "courtroom" demeanor seems to grow even sweeter as the years go by.

Southern California and Southern Counties Gas companies, El Paso Natural Gas Co., Transwestern Pipeline Co., et al, could find little agreement with proponents of Enchilada Inch. One or more of the protestants found the following faults with the plan.

Concern was expressed about an unregulated direct purchase of Texas gas by Edison at prices substantially above regulated prices in that area. They said the effect will be a bidding up of all gas prices in the Gulf coast to the detriment of all gas users.

They hit hard and heavy at the idea that loss of Edison's (and perhaps other) load-balancing interruptible sales will result in higher gas prices to other classes of gas consumers in southern California. And they intend to show that air pollution factors, as introduced by applicants, are not actually valid.

The air pollution factor was attacked by pointing out that Pacific Lighting Corp. operating companies have never failed to deliver enough gas to permit 100 per cent gas burning during months when smog mitigation requirements (APCD Rule 62) have been in effect. It was placed before the commission that the Enchilada Inch gas will contain more hydrogen sulfide and organic sulfur than does Edison's current natural gas supply.

The gas distributors also said that they can supply Edison's loads if two assurances are forthcoming: (1) that regulatory agencies approve large new supplies with a portion allocated to steam-electric plant use, and (2) that steam-plant customers themselves will maintain contracts to buy the gas.

Pacific Lighting then contended that light is breaking through on these matters as the approved Rock Springs projects seems to take care of the first. And the Edison-Humble contracts indicate Edison is now ready to sign long-term gas supply contracts for gas at higher prices than those now in effect for gas purchased from regulated utilities in southern California.

The protestants displayed feelings that the Enchilada Inch project would by its direct sale take away some firm gas from gas consumers in southern California that normally would be available for peak space heating periods when Edison would be fired with alternate fuel. And, they stated that the higher priced gas from the proposed project would increase electric rates for Edison's customers. They maintained that the main convenience would be for SoCal-Ed's management, rather than for the public.

They suggested that the Texas-Mexico-California project is not economically feasible at rates shown by the material submitted to the commission. And, it was pointed out that most of the gas to be handled in the proposed pipeline will not be available to gas consumers of southern California as peaking service since U. S.-produced gas in the plan is not available for resale at all. The only gas that can be used is that from Mexico and Pemex, and protestants are not so sure that such gas will be available in any substantial volume.

One of the protestants said the Mexican route is contrary to the interests of both the United States and California because:

1. Enchilada Inch intends to use Mexican steel and labor for the in-Mexico leg at a time when the U. S. steel industry has its problems and unemployment is high.

2. The financial arrangements would add to the already severe strain on U. S. gold reserves.

3. Assuming Enchilada Inch did take the Edison load, the character of Pacific Lighting Corp.'s distribution properties would have to be shifted, probably leaving Edison entirely dependent on the TGT-Pemex project for basic fuel supply, and would erase any PLC companies' ability to then serve Edison in an emergency, if at all.

4. Many missile, electronics, and aircraft industries depend on Southern California Edison as the sole source of electric energy; hence, it does not reflect a good national defense position to have such vital works dependent on a utility with a prime fuel supply running some 1200 miles through a foreign country.

5. The proposed project is transportation of gas in interstate commerce by provisions of sections 1(b), 2(6), 2(7), and 7(c) of the Natural Gas Act, and no certificate under these sections has been applied for. Also, the protestants seem to feel that the whole scheme is devised in an attempt to avoid regulation of the rate for the sale of natural gas by the producers.

6. It is not in the public interest for firm volumes of natural gas to be used for boiler fuel where many consumers are dependent thereon for superior uses.

One of those against Enchilada Inch, El Paso Natural, stated that the project cannot be built without authorization from the Government of Mexico, and: "El Paso is informed and believes and therefore states that such authorization has not been given."

In this respect, there is still speculation that while Pemex is obviously all for the project, there is an undercurrent, that is reluc-

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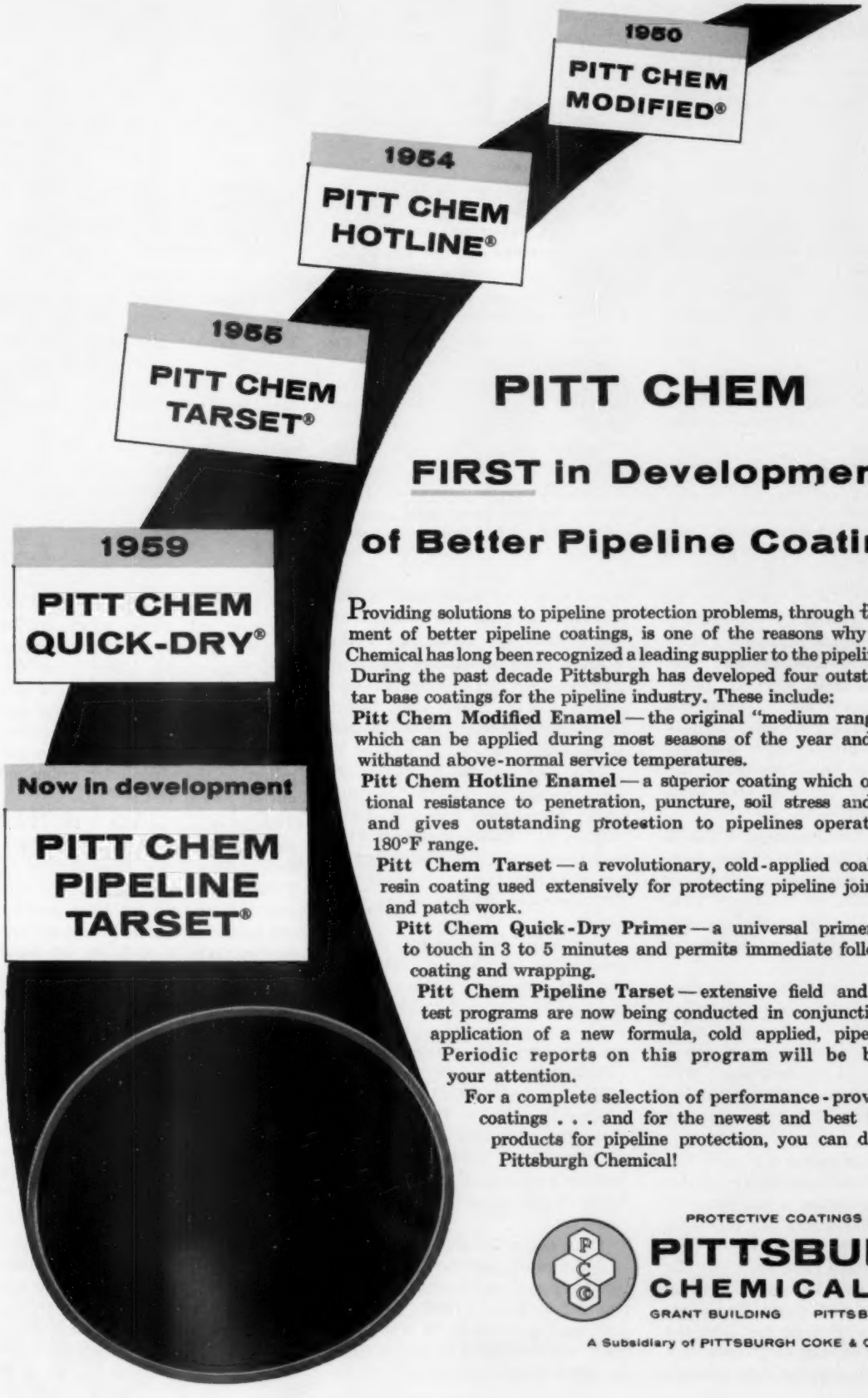

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Enchilada Inch

(*Continued from page* 160)

tant to leave, which implies that the president of Mexico and other officials of that great Republic just may not wholeheartedly go along with the plans. However, the head man at Pemex, Sr. Ing. don Pascual Gutierrez Roldan, director general, was in Los Angeles shortly after the hearings. He said, "Every possibility has been checked and it ("The Project"—Ed.) is feasible from economic, political, and technical viewpoints."

Sr. Roldan conferred with California's Gov. Brown and with officials of Southern California Edison, Tennessee Gas, and Calgas, among others. Pemex' dynamic director said Governor Brown first learned of the Mexican interest in the project when he (Brown) was in Mexico three months ago and visited with President Mateos.

Sr. Roldan let it be known he is aware of efforts by International Gas Co. which proposes a similar, though all-Mexican gas, project. Roldan finds, however, International's plans not practical due to a more costly route and inability of Mexican production to meet International's demands—some 500 MMcfd from Reynosa area fields and perhaps others.

Back to the hearings— Pacific Lighting's "floor fight" was handled by tall, aggressive, able Harry P. Letton Jr., of Southern California Gas Co. His verbal jabbing during clarifying questioning was effective.

He quickly brought out that while letters agreement between Enchilada Inch proponents were many, formal contracts were few—at the time of the hearings. TGT et al countered by saying contracts would be at hand at the specified time.

Letton established the need for, and Tennessee Gas willingly agreed to make available, a mountain of additional paperwork for following stanzas of the proceedings. This material ranged right back into the gas fields for technical data on quantitative and qualitative properties of the involved gas; over the Texas, Mexico, and California segments of the pipeline for complete engineering, cost, economic feasibility, etc., for each segment, along with reserve evaluations where applicable; several contracts; and working papers from which several exhibits were evolved. In short, it looks to us like TGT will have to bring everything short of the Ten-Ten Parking Garage before the California PUC.

In effect, in our opinion, the California hearings on the Enchilada Inch will approximate a full-blown Natural Gas Act 7(c) case before FPC in scope and exhibition.

Other factors are of some notice relative to the overall matter. Just before the hearings opened, the Supreme Court of the United States affirmed FPC's power to consider end use and producer price impact in a case where a utility purchased natural gas direct from producers for boiler fuel in the conversion of gas into electricity. This was the Transco X-20 case which would have had Transcontinental Gas Pipe Line Corp. transport said gas for the account of Consolidated Edison of New York.

Enchilada Inch backers appeared unworried by this decision. Opponents, on the other hand, found considerable comfort in the words of the high court.

And, also just before the hearings cranked up, Pacific Lighting Corp. companies sent to California's PUC their compliance with conditions the regulatory agency had placed on their portion of the FPC-approved Rock Springs proposal.

The main cure submitted was elimination of higher rates to southern California gas consumers during early years of Rock Springs. This was accomplished, if sanctioned by regulatory agencies, by: (1) renegotiation of the California-border gas prices for the sale by El Paso Natural to Pacific Lighting companies, and (2) handling additional gas under the Rock Springs approvals through existing facilities during early years of that project.

Thus the price was rolled back to 33.38 cents per Mcf during the interim years, and then to 40 cents per Mcf on Jan. 1, 1964. The first additional gas will be 70 MMcfd in 1962, and will build to 185 MMcfd in 1963—both increments to be handled by slightly modified existing facilities. The new Rock Springs pipeline project will be built to come into operation on Jan. 1, 1964. During that year the additional delivery will increase to 265 MMcfd. The full initial volume, 470 MMcfd, including 70 MMcfd of best-efforts gas, will be hit in 1965. The ultimate Rock Springs capacity under full development of its initial construction and development phase will be 910 MMcfd.

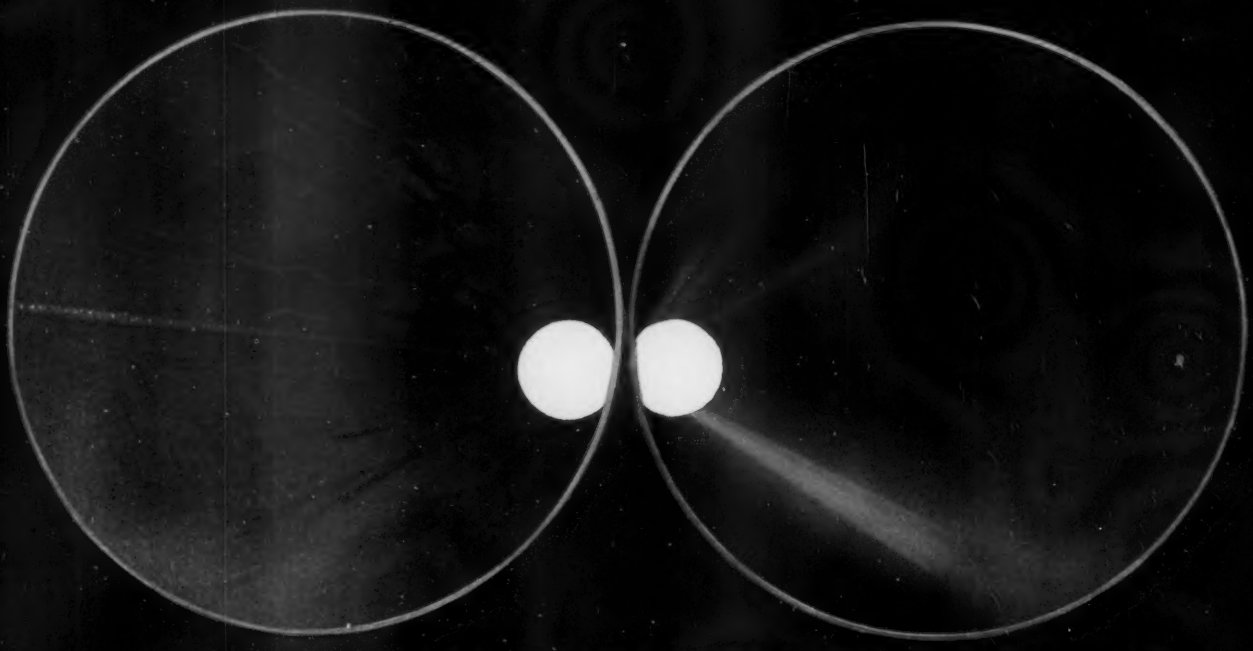
All back-up contracts to effect the modified Rock Springs plan have been buttoned up and were so prior to submissal of the "conditions met" instruments. El Paso Natural and Colorado Interstate will have to go back to FPC. However, since that commission approved the project "as was" in the first place, no difficulty is expected.

The local southern California gas companies state they have offers before the PUC of high-continuity gas up to 350 MMcfd for steam plant use during, for all practical purposes, all times when APCD actually requires natural gas burning. They plan to place before the commission an alternative (to Enchilada Inch) proposal during Application 42931 proceeding, doubtlessly involving Rock Springs gas reflecting the supplement order, as, and if, issued by Cal-PUC.

Meanwhile, at the FPC, TGT filed an answer to Southern California Gas Co.'s intervention in TGT's applications for export and import authority in the matter of the Enchilada Inch. Tennessee Gas further said it will file, at some unnamed date in the future, an application for an FPC disclaimer on need for a Section 7 proceeding; or, failing a disclaimer, for an FPC certificate under that section of the Natural Gas Act. This has not been filed as we go to press.

Neutral experts tell us that it is not likely that Federal Power Commission will let this jurisdiction escape.

The California PUC hearings were recessed on Jan. 27 until March 15-17 in the old State Building in Los Angeles at 10 a.m. It will take more than a broken leg to keep us away when and if cross examination can come up in those dates. ■



At the right above is one section of a 30" line pipe internally coated with Napko's Epoxycote Pipeliner, the first amine-cured epoxy resin specifically formulated for gas line transmission. Epoxycote Pipeliner has now been used in all parts of the country with equally good results, providing a surface smoothness that increases line-flow efficiency and reduces maintenance costs. The uncoated section at the left shows severe pitting that can occur during transit and storage and that can be prevented by Epoxycote Pipeliner.

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For complete details and published project references write to

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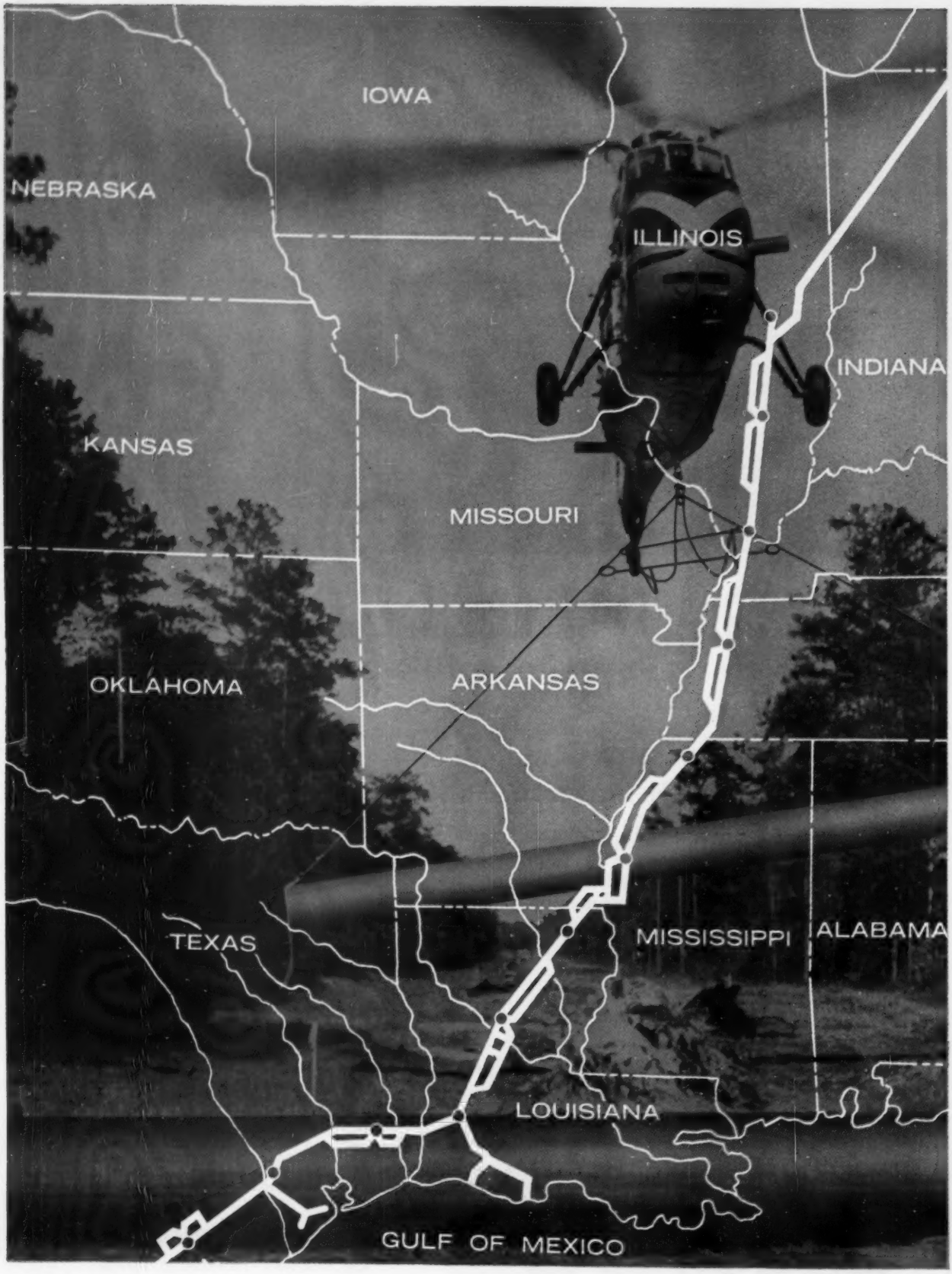
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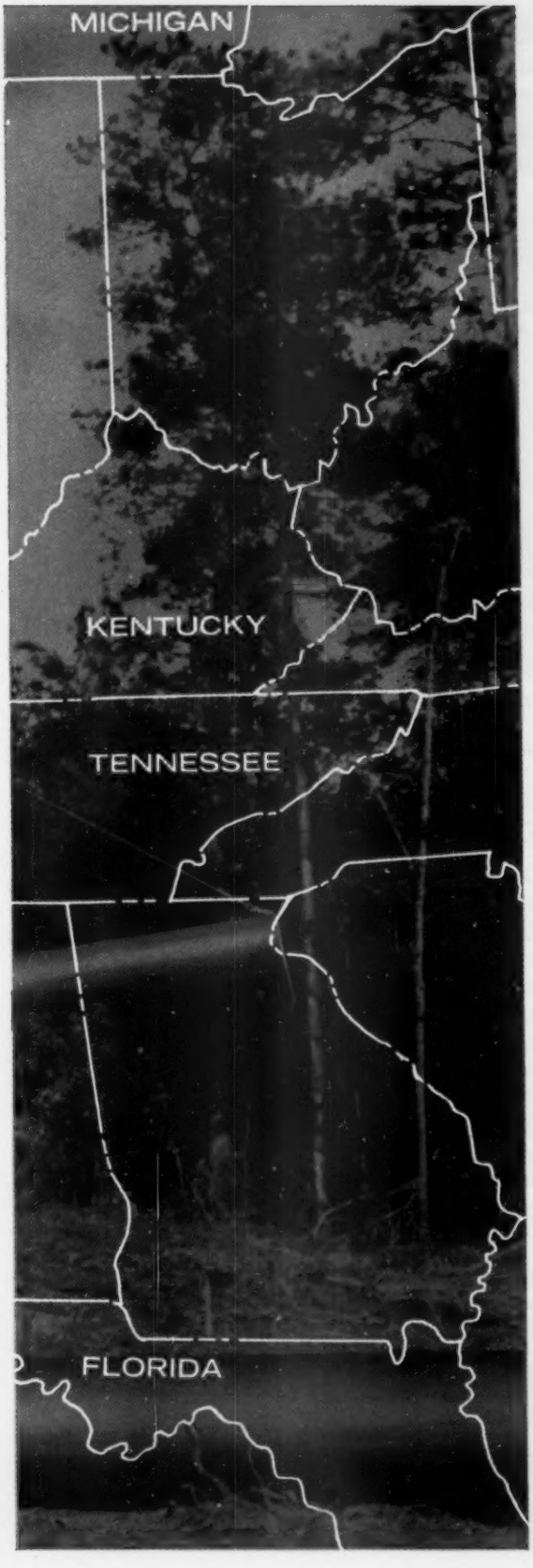

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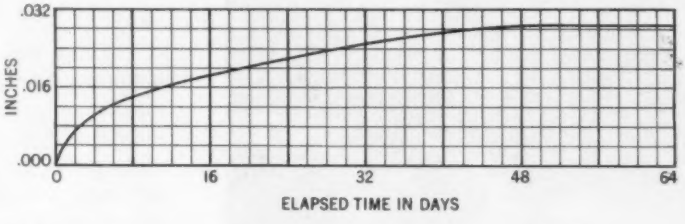

Its low coefficient of friction causes it to slide easily inside casing. The M-2 is completely resistant to impact fracture (4.0 ft. lbs./in. notched) and has successfully worked on 36" pipe, ½" wall, pulled in excess of 500 feet. We are convinced that it will perform as well or better than any other insulator on the market, including all known steel types. Other physical properties: *Dielectric strength* — (short time, ⅛" thickness) 500 volts per .001 inches (D149-55T); *Tensile strength* — 4400 p.s.i. at 20 in./min.; *Elongation* — 25% 20 in./min.; *Abrasion resistance* — Taber index 5.7.

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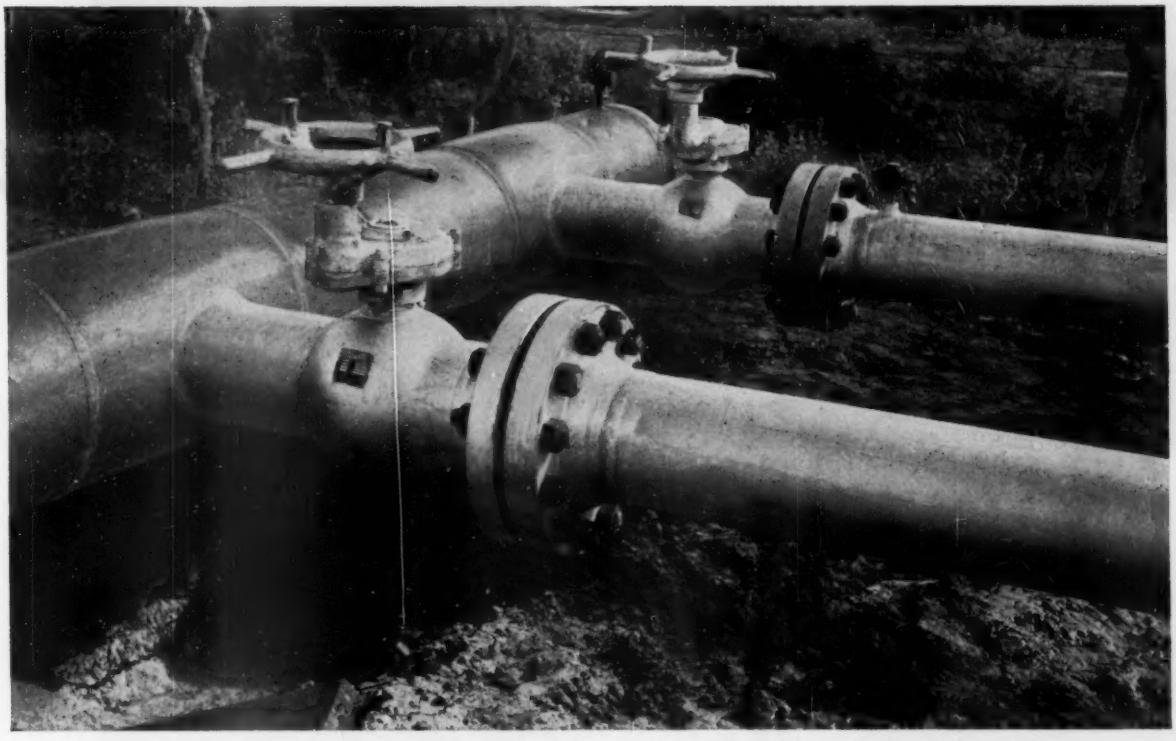

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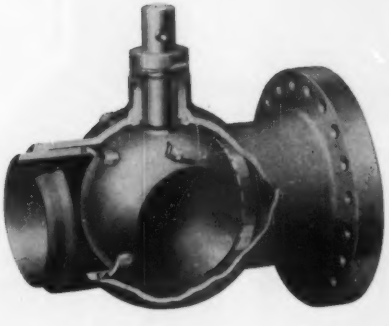

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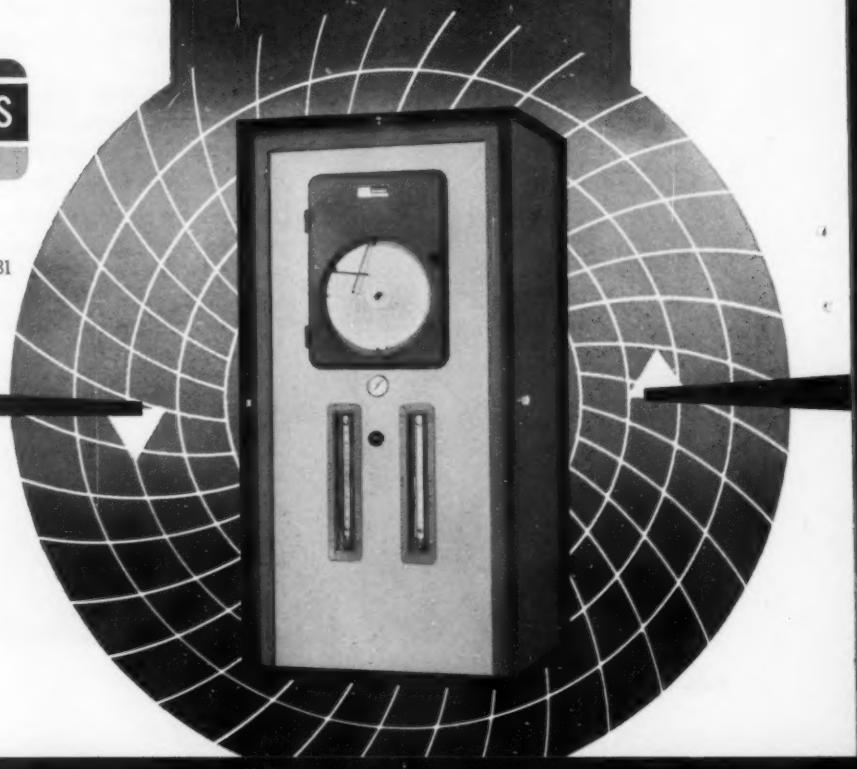

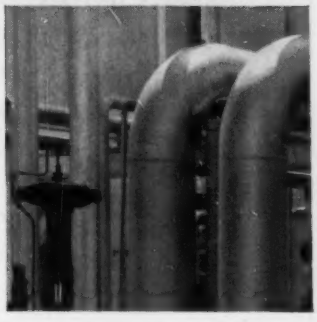

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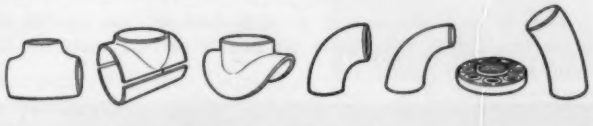

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"30 Years of Pipe Coating Testing"

FPC prices eastern Kentucky gas

FPC ruled that rate increases by two independent gas producers selling gas from fields in eastern Kentucky, should be allowed.

United Carbon Co., Charleston, W. Va., and Columbian Fuel Corp., New York, are the producers; United Fuel Gas Co., Charleston, is the pipeline customer. The producers have been collecting the increases—a little more than $400,000 a year—since April 1956.

FPC used the rate base method in its determination. The proceeding was carried out and a decision by a presiding examiner was rendered before FPC handed down its Phillips Petroleum Co. ruling and its general policy statement 61-1. Evidence was presented on a cost-of-service basis, FPC said. Therefore, "it is appropriate" to decide these cases on an individual company basis using that method. FPC also noted that its general policy statement did not cover the eastern Kentucky area.

Commissioner Arthur Kline dissented in part. He favored the field price approach and believed that ultimately all producers in the same area should receive the same price. But, he said the commission did not have evidence of what is a fair price for gas in the eastern Kentucky area. He said he did not consider a 26-cent price for United Carbon to be justified merely because that price is just and reasonable for Columbian Fuel.

Herscher increase okayed by FPC

FPC okayed Natural Gas Storage Co.'s plan to build facilities that will enable the company to take larger quantities of gas from the Herscher storage field.

Three existing 2000-hp compressor engines will be supercharged to 2800 hp, a gathering system will tie-in new wells, and seven new injection-withdrawal wells will be drilled in the Mt. Simon and Galesville reservoirs.

Maximum daily withdrawal will be increased by 75 MMcf to 725 MMcf.

KERMAC *Outerwrap* KERMAC

resists damage during lowering-in and backfilling

Kermac — the tough, durable glass Outerwrap — provides thoroughly reliable protection against the damaging effects of soil stress. Reducing the threat of costly holidays that often result from these operations is important to the economy of any pipe line, and Kermac Outerwrap is designed specifically for that purpose.

Kermac's bonded, fibrous glass mat is reinforced by strong glass yarns, and is saturated with special bitumens. These outstanding features assure a constant and adequate safeguard for your protective enamels during lowering-in and backfilling.

Your Midwestern Man is a ready and reliable source for further information or assistance on this important material. Call, write or wire.

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CLEAN AND DRY

THIS MAKES THE DIFFERENCE
Unobstructed gas inlet and outlet are provided by mounting cyclone tubes between the inlet and outlet plenums permitting the clean, dry gas to be discharged between the tube sheets.

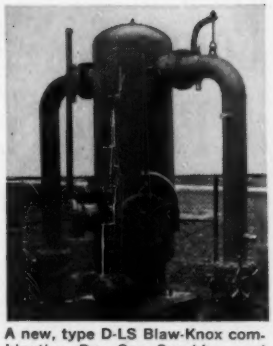
THIS MAKES THE DIFFERENCE
Inlet plenum assures even distribution of gas to the cyclone tube inlets. No chance of plugging tubes as bulky solids and liquid slugs drop out here.

THIS MAKES THE DIFFERENCE
Cyclone tubes of abrasion-resistant, alloy cast iron, 450 Brinell hardness, ¼" minimum thickness. Cast tubes permit the intricate inlet contours needed for efficient operation.

NEW—DIFFERENT. The Blaw-Knox Type D-LS Combination Dry Gas Scrubber and Liquid Separator delivers clean, dry gas. The new type D-LS Scrubber features:

- An inlet expansion separation plenum,
- A solidly welded tube bank into which the clean and dry gas is separately discharged,
- Miniature cyclone tubes of alloy cast iron construction employing the highly efficient helical flow principle to separate entrained solids and liquids from the gas,
- A tube eject or outlet plenum into which are discharged the solids and liquids removed by the highly efficient cyclone tubes.

We would like you to know more about our new Scrubbers. Write for Catalog No. 394—or ask for our representative to call. Buflovak Equipment Division, Blaw-Knox Company, P. O. Box 2041, Buffalo 5, New York.



A new, type D-LS Blaw-Knox combination Dry Gas Scrubber and liquid separator installed at a town border station in Ohio.

Buflovak Equipment Division

BLAW-KNOX

Repeat purchases —the best endorsement for Polyken

1956 INSTALLATION, Chester to Bellwood, Va., 4.5 miles of 6" pipe

1960 INSTALLATION, Boswell's Tavern to Gum Spring, Va., 26.7 miles of 18" pipe

Commonwealth Natural Gas makes repeated use of Polyken® tape on strength of past performance

Officials of Commonwealth Natural Gas Corporation of Richmond, Va., were impressed in 1956 with the many advantages of Polyken protection. With confidence based on the cathodic protection needs of their Polyken tape-coated 1956 Bellwood line (*inset photo*), they put this coating to work two years later on their Chester to Petersburg, Va., line (12 miles of 18" pipe). In 1959, *more* Polyken coating . . . Waverly to Ivor, Va., (15.8 miles of 12" pipe). And most recently, the line from Boswell's Tavern to Gum Spring (*main illus.*).

It stands to reason that repeated use is founded on first-hand satisfaction and trust. Many discriminating companies make Polyken protection their standard specification because of its dependable performance. Get full details on Polyken performance and economy from your representative, or write Polyken Sales Division, 309 West Jackson Boulevard, Chicago 6, Illinois.

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Patterson Supply Co.

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Cathodic Protection Service

Jackson, Michigan
Utility & Industrial Supply Co.

Long Beach, California
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Polyken

Experienced in modern PROTECTIVE COATINGS

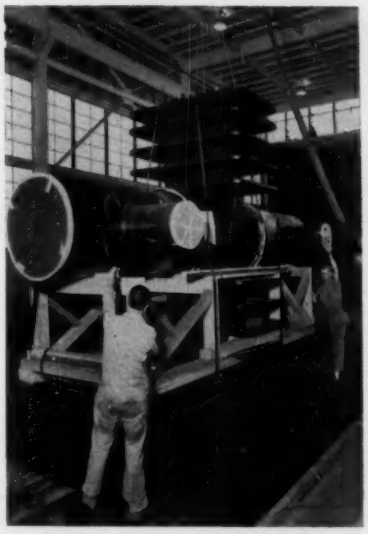
Two Georgia towns get gas supply

FPC presiding examiner Glen R. Law authorized South Georgia Natural Gas Co., Thomasville, to construct lateral lines to provide natural gas in Sylvester and Ocilla, Ga.

Peak-day deliveries are estimated at 406 Mcf in the first year and 585 Mcf in the third year for Sylvester. In Ocilla, estimates are 273 Mcf in the first year and 424 Mcf in the third.

Law conditioned the approval to require the two Georgia towns to submit within 12 months proof that they have sold the bonds needed to provide funds for their projects and that construction of distribution facilities has commenced.

Three companies that sell and distribute LPG in the area intervened in the case. They claimed that the plan was not economically feasible for the company nor the two cities. Presiding Examiner Law said he was "inclined to believe that they protest too much . . . their protests indicate that they fear the proposed service will be successful and result in reducing their sales . . . ."



The first huge mainline gate valve which will be installed in the 1400-mile, Alberta-California pipeline project of Pacific Gas & Electric Co. has been shipped out by Grove Valve & Regulator Co., Oakland, Calif. The 36-in. valve weighs more than 28,000 lb and will be about 20 ft high when the "operator" — or control mechanism—is installed at the job site.

Transco wants gas service from N. Y. State

New York State Natural Gas Corp. wants to render natural gas storage service to Transcontinental Gas Pipe Line Corp.

In an FPC filing, New York Natural said that Transco will deliver gas to New York's transmission system in the summer. It would be held in New York Natural's storage pools until Transco's Eastern Seaboard customers need it for cold winter days.

Service would begin April 1, 1961, so that gas could be redelivered to Transco during the winter of 1961-62.

After the first year, capacity available to Transco would be 7.5 billion cu ft of gas, which could be delivered back to Transco at a rate of 150 MMcfd for a maximum of 50 days. By giving advance notice, Transco could store up to 10 billion cu ft.

New York Natural said it would use its general system storage pools and other facilities for the service. This would permit maximum flexibility of operation in handling the gas.

TGT builds petrochemical plant

Tennessee Gas Transmission Co. will build a multi-million dollar petrochemical plant on its Houston Ship Channel property. A long-term marketing association has been formed by TGT and Cary Chemicals Inc., East Brunswick, N. J.

Although Cary will continue as an independent, publicly owned corporation, TGT will have a substantial interest in it.

Completion of TGT's plant, in which Cary is expected to have an equity participation, is slated for 1962.

The facilities will consist of two units. One will have an initial annual capacity to manufacture 100 million lb of acetylene, one of the principal petrochemical "building blocks." Its raw material will be methane. The second unit will covert a major part of the acetylene into vinyl chloride monomer (VCM).

Northern wants to add to customers' supply

Northern Natural Gas Co., Omaha, wants to increase its gas supply to presently served customers by 18 MMcfd for the 1961-62 heating season.

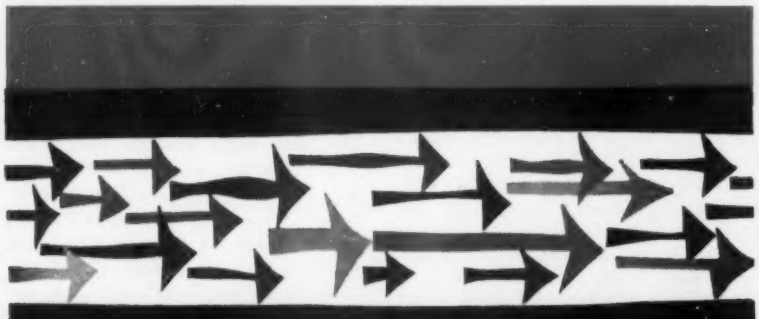
In its FPC filing, Northern also proposed to start the sale of 40 MMcfd from the Mt. Simon reservoir of the Redfield, Iowa underground storage field. This will increase total daily withdrawals from Redfield to 140 MMcf. Northern currently can deliver 100 MMcfd from the St. Peter reservoir at Redfield.

FPC reports to Congress

In its 40th annual report to Congree, FPC outlined the steps it has taken to cut down the increasing regulatory lag. The commission said its rising workload came at a time when it was facing complex new utility regulatory problems—reaching far beyond the economic concepts of 40 years ago, when FPC was created.

The 105-page report reviewed significant developments in the natural gas and electric power industries which had broad impact on FPC activities during the 1960 fiscal period. These included the Canadian government's decision to permit the export of large volumes of natural gas into the U.S., as well as the continuing expansion of the nation's gas and electric utilities.

Copies of the report are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. Cost: 35 cents.



Copon gives more pipeline thru-put . . . up to 6% more!

The industry's only field tests prove it!

ONE epoxy coating for internal coating of pipelines has been field tested on large diameter gas transmission lines. Just one. That is Copon.

The results of the industry field tests show that deliverability can be increased—"an additional one to six per cent increase directly attributable to internal coating." We'll be glad to send you reprints of the *Pipe Line Industry* and *Gas* magazine feature articles which report these tests in detail.

The increase in pipeline thru-put is a welcome *bonus* you get with Copon. Other benefits include maximum corrosion protection . . . reduced maintenance costs . . . delivery of cleaner products.

Special applications are available for coating dehydrated gas lines, crude and petroleum product lines, salt water or fresh water lines, and oil well tubing and casing. Find out more—write or call for all the facts on how *Copon* can give you more thru-put.

FOR CORROSION CONTROL

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'61 Petroleum council named

New members of the National Petroleum Council have been named. Among them are:

F. M. Banks, Southern California Gas Co.; Eskil I. Bjork, Peoples Gas Light & Coke Co., Orville S. Carpenter, Texas Eastern Transmission Corp.; James Comerford, Consolidated Natural Gas Co.; George R. Copeland, Algonquin Gas Transmission Co.; Paul Endacott, Phillips Petroleum Co.

Also, Paul Kayser, El Paso Natural Gas Co.; N. C. McGowan, United Gas Corp.; William G. Maguire, Panhandle Eastern Pipe Line Co.; W. E. Mueller, Colorado Interstate Gas Co.; C. Pratt Rather, Southern Natural Gas Co.; L. T. Potter, Lone Star Gas Co.; S. D. Whiteman, Kansas-Nebraska Natural Gas Co.; and George S. Young, Columbia Gas System.

Compressor institute set for April 4-5

The eighth annual Gas Compressor Institute will be held April 4-5 in Liberal, Kan. New developments applicable to operation of gas compressor engines and related equipment will be presented.

Subjects to be covered include torsional vibration, ignition, oil lubrication systems, repair methods, and metal lock process. Also planned is a panel on automation and a discussion on aluminum bearings and things to come in the operation of large internal combustion engines and gas compressors.

Additional information is available from O. D. Calhoon, Sr., the University of Kansas, Southwest Kansas Center, Box 653, Garden City, Kan.

200/1000 BHP

635 HP Engine-Compressor Package in service pumping gas for Liberty Gas Transmission Company, Hull, Texas. This unit is a matched combination of Superior 8G-825 gas engine and White W-64 four cylinder compressor.

White-Superior *matched design* ENGINE-COMPRESSORS

White Diesel announces a line of medium speed, heavy duty, balanced opposed compressors, 200 to 1000 BHP, specifically engineered for combination with Superior natural gas engines. The complete, compact, *matched design* engine-compressor package provides continuous, heavy duty service for gas gathering, gas lifting, repressuring and booster applications.

Six inch stroke White compressors coupled to 9 inch and 10½ inch stroke Superior oil field gas engines provide optimum combinations of piston speed, horsepower and service life. Model W-62, two-cylinder compressor, ranges from 200 BHP with Superior 6G-510 gas engine to 635 BHP with 8G-825. Model W-64, four-cylinder compressor, is rated up to 1000 BHP with supercharged 8GX-825 gas engine. Standard cylinder sizes range from 4000 PSI, 2⅝" dia. to 85 PSI, 22½" dia., providing 68 different cylinders. Custom sizes and designs available.

Speed of direct-connected engines (no belts or gears) can be varied from 600 to 900 RPM for easy control of compressor unit. Compressor cylinders can be easily changed on same frame to suit changing volume or pressure conditions.

Get new Bulletin 124 from White oil field representatives . . . or write today to:

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White Diesel
WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

Introducing...

the Shellfish

*UNDERWATER

FERROUS METAL DETECTOR

The F. H. Maloney Company now offers an underwater ferrous metal detector: The *Shellfish*. Manufactured under license from the Shell Development Co., the detector locates pipe lines and crossings buried to depths as great as 15 feet, depending on pipe size.

The *Shellfish* saves barge, workboat-crew, and diving time, and can be handled on any boat normally used in offshore operations. It is available on day-, month-, or year-lease. For details and leasing information, please contact The F. H. Maloney Company, Houston.

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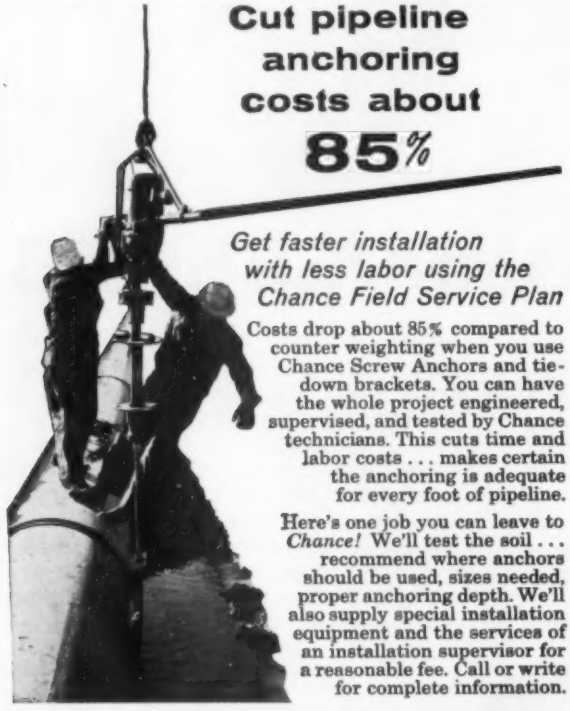

Cut pipeline anchoring costs about 85%

Get faster installation with less labor using the Chance Field Service Plan

Costs drop about 85% compared to counter weighting when you use Chance Screw Anchors and tie-down brackets. You can have the whole project engineered, supervised, and tested by Chance technicians. This cuts time and labor costs . . . makes certain the anchoring is adequate for every foot of pipeline.

Here's one job you can leave to *Chance!* We'll test the soil . . . recommend where anchors should be used, sizes needed, proper anchoring depth. We'll also supply special installation equipment and the services of an installation supervisor for a reasonable fee. Call or write for complete information.

Petroleum Equipment Engineering and Services Division of

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C061-4 INTERNATIONAL DIVISION • CENTRALIA, MO., U. S. A.

New pipeline coating tested

Recent developments based on high polymer thermosetting epoxy resins offer a useful and different kind of pipeline coating. Systems such as Epoxy-Kote 695* have passed rigorous lab tests conducted by utilities and have shown excellent corrosion resistance, flexibility, toughness, and abrasion resistance.

The Epoxy-Kote formulation was developed to answer the need for a metal pipe coating which could withstand the extreme abrasion encountered when pipe is jacked through a bore hole.

In testing for abrasion resistance, sharp rocks were pounded into a semi-circular hardwood channel and coated pipe was forced across the channel at 150 psig at points of contact. Although the coating surface was scuffed, at no point was metal exposed.

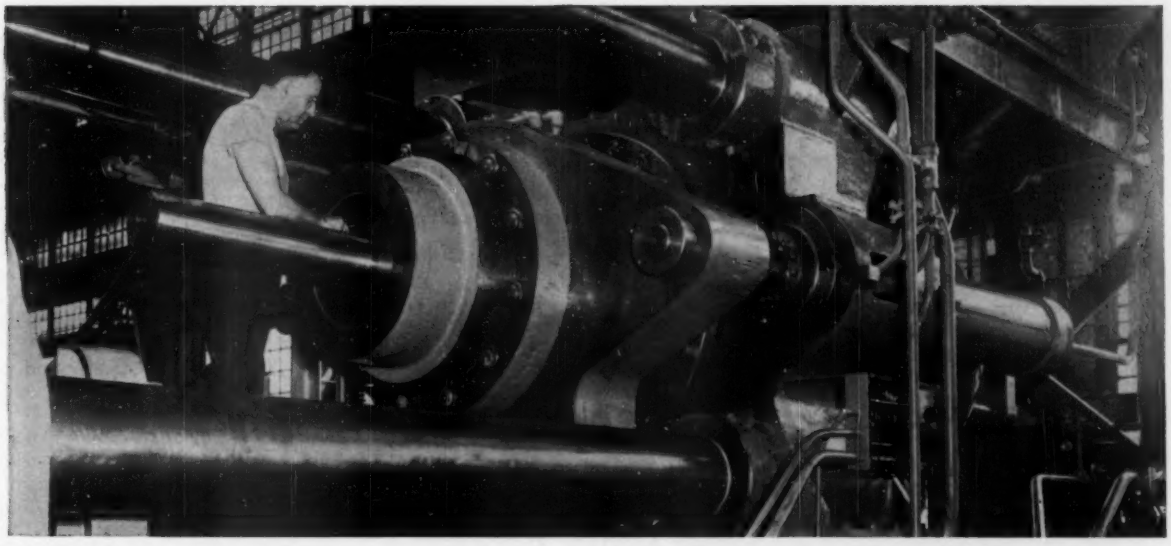
Testing for corrosion resistance was conducted by electrolysis in a gas company lab. One-inch pipe with metal nipples coated with Epoxy-Kote was immersed for 30 days in alternating fresh and salt water. Current was changed to run both ways (outside the coating to inside; from the pipe to outside the coating). In neither instance did the coating break down.

Fairly long-term practical exposure of the coating was acquired by in-soil testing of coated 40-in. pipe. When brought up for examination after three years, the pipe showed a small 1½-in. wide by 5-in. long scratch which penetrated to the metal. All other coated areas were intact.

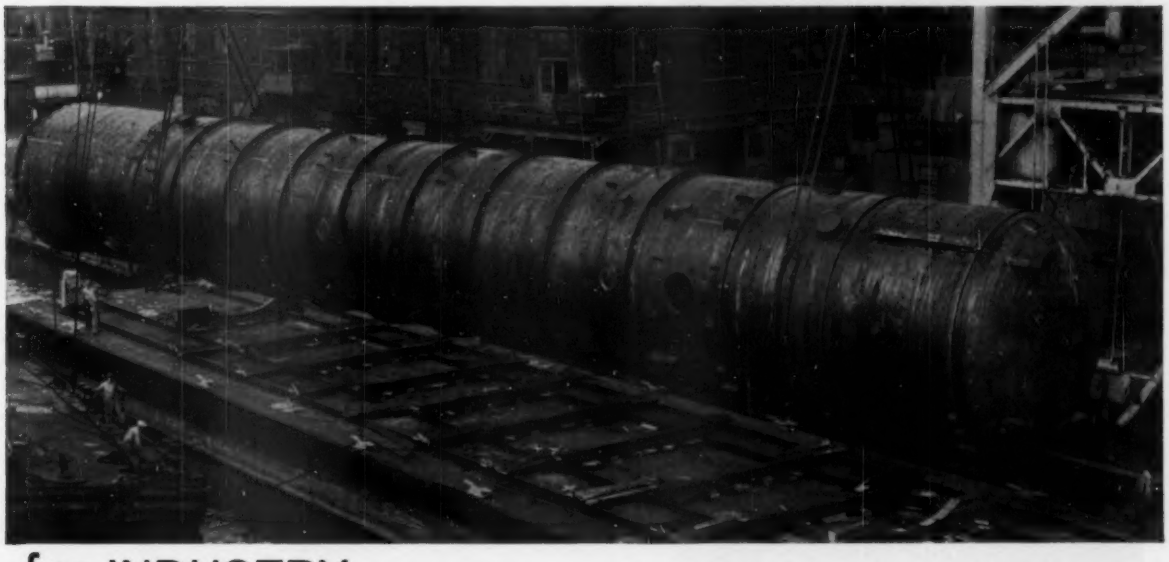
Mixing and application of the coating is quite simple. Preformulated and separately packaged resin and hardener are thoroughly mixed just prior to use. Application by brush or roller over clean, dry pipe is recommended. Two coats, to achieve an average thickness of .032 in., are suggested. After 12 hours of cure, the coating is hard enough for testing with an electrical pin-hole detector. If voids are found, they are spot patched and the pipe is ready for shipment to the job site.

Epoxy resins have valuable commercial significance as adhesives where they even replaced welding in effecting metal-to-metal bond.

*Trademark of Carl H. Biggs Co., Santa Monica, Calif.



SUN SHIP has what it takes to build . . . . .



for INDUSTRY

We're old hands at building complete machines and special equipment for use in a wide range of industries. For 44 years our large and amply equipped shops have produced items ranging from small tanks to huge fractionating towers, pressure vessels, stills, plate work and special-purpose machinery for the chemical, petroleum and other industries.

Pictured here are a hydraulic press, which was shipped by rail, and a fractionating tower ready for loading on a barge for shipment by water to an oil refinery. They are just two examples of the equipment Sun Ship contributes to many fields, also examples of our shipping facilities.

Because we have all the facilities, we build all equipment right in our own plant, without subletting. Our convenient location on the Delaware River, with direct access by rail and water to all points, assures speedy delivery.

Let Sun Ship solve your machine or equipment problem. Phone or write our Sales Engineering Department.

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SHIPBUILDING & DRY DOCK COMPANY

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Northern buys Transwestern stock

Northern Natural Gas Co. is acquiring a 16 per cent interest in Transwestern Pipe Line Co. The $11.8-million transaction calls for purchase of 950,000 shares of Transwestern stock at $12.50 a share.

Northern chairman John F. Merriam said the acquisition gives "Northern shareholders an interest in a completely new market area." Transwestern recently completed its $200 million pipeline running from west Texas to California.

Mainline boost

A 4-state, $15 million expansion program of Columbia Gulf Transmission Co. will boost gas supplies to Ohio Fuel Gas Co.

Columbia Gulf will build 96.9 miles of 30-in. mainline loops and 29 miles of 12-in. lateral supply lines to raise its pipeline capacity by 52 MMcfd.

ABOVE GROUND

UNDER-GROUND

UNDER WATER

WHEREVER YOUR PIPELINE GOES
LET LATEX PUT IT THERE

General Contractors for the Oil and Gas Industry for over Twenty-Five Years.

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GAS • Pipeline Notes

Mississippi River Fuel Corp., St. Louis, owner of 25 per cent of the Class A common stock of the Missouri Pacific Railroad, has strengthened its position on the railroad's executive committee. MRF's chairman William G. Marbury is chairman of the MoPac executive committee. The committee was also expanded. to include Raymond V Terry, MRF vice president and a MoPac director.

Columbia Gas System has a new color motion picture that tells the story of the first use of a jet engine for stationary power. The film, "The Constant Search," traces the conception, research, and testing of the RT-248 and eventually its start-up in a prototype gas compressor station at Possom Trot, Ky.

Williams Pressure Service Co., Shreveport, has formed a Canadian subsidiary. James Belding, vice president of the company, heads the Canadian operation located in Calgary. John Ench is vice president in charge of the Edmonton office.

Williams Brothers Co., Tulsa, is doing the design-engineering work on the proposed LPG line of Trans-Southern Pipeline Co., subsidiary of Transcontinental Gas Pipe Line Corp.

Daniel Orifice Fitting Co., Houston, has named Berkley Engineering & Equipment Co., Honolulu, as sales representative for Daniel products throughout the Hawaiian Islands.

General Electric is spending more than $1 million this year to enlarge its communications products department headquarters in Lynchburg, Va.

Position Available
Experienced Natural Gas Distribution System Operator

Gas manager position available to qualified person in prosperous Iowa community. Six to eight years' experience required in gas distribution system operation, maintenance, appliance adjustment and inspection. Position will require control of gas loads, meeting public as cities gas representative and manager, and other management and inspection duties.

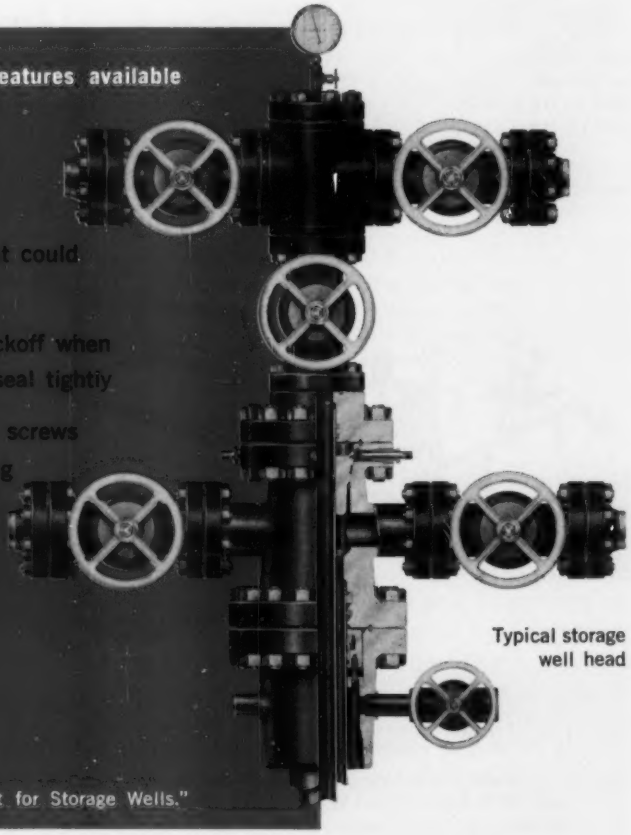
Address replies and resume of qualifications to City Clerk, Manilla, Iowa

O·C·T can solve your storage well-head problems

OCT engineering has provided effective solutions to the problems of equipping LPG and natural gas storage wells for several years. This wide experience goes to work for you with every OCT Christmas tree you install.

Here are some of the OCT well-head features available to solve storage problems:

- a full range of well-head equipment to handle any need
- flanged connections to stop leakage that could occur at screwed connections
- lockdown screws to provide positive packoff when shallow casing strings are too light to seal tightly
- threaded casing hangers with lockdown screws to prevent vibration from loosening casing and allowing it to fall
- strippers to permit casing movement during cavern-washing operations
- the large well-head equipment needed to meet typical storage-well needs



Typical storage well head

Write for our booklet "O-C-T Well-Head Equipment for Storage Wells."

where progress is a daily practice

O·C·T

OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Address Export Inquiries for All Countries to
P. O. Box 3091, Houston, Texas.

The first carload of X-Tru-Coat was shipped recently from Sparrows Point, Md., by Pipe Line Service Corp. to a Hialeah, Fla., gas distributor. By midspring, Pipe Line Service will be offering X-Tru-Coat from its new Youngstown, Ohio plant. This plant also will be equipped to apply coal tar, asphalt, and wax base coatings.

Continental-Emsco Co., Dallas, is distributing Oil & Gas Supply Co.'s packaged Joy gas compressor units.

Transcontinental Gas Pipe Line Corp., Houston, has set up a Pennsylvania storage department, headquartered in Williamsport, Pa. In addition to operating Transco's own extensive facilities in Pennsylvania, the department's staff will serve as field liaison with the Leidy storage pool.

El Paso (Texas) Natural Gas Co. won approval of its plan to construct and operate a 3400-hp addition to its Eunice Field compressor station in Lea county, N. M. The $1.2-million facility will let El Paso take about 28 MMcf of residue gas from Phillips Petroleum Co. in the Eunice field.

Transcontinental Gas Pipe Line Corp. plans a 15-mile, 36-in. loop in North Carolina. The loop will bypass the reservoir of a Duke Power Co. hydroelectric project under construction on the Catawba river. Water impoundment at the project will flood about 5.5 miles of Transco's existing mainlines to depths of 60 ft. Duke would reimburse Transco some $1.4 million.

Forty-one town border stations have been completed in Iowa, Missouri, Illinois, Wisconsin, and Michigan for Michigan Wisconsin Pipe Line Co. Contractor was C. E. Wilson Construction Co., Kansas City, Mo.

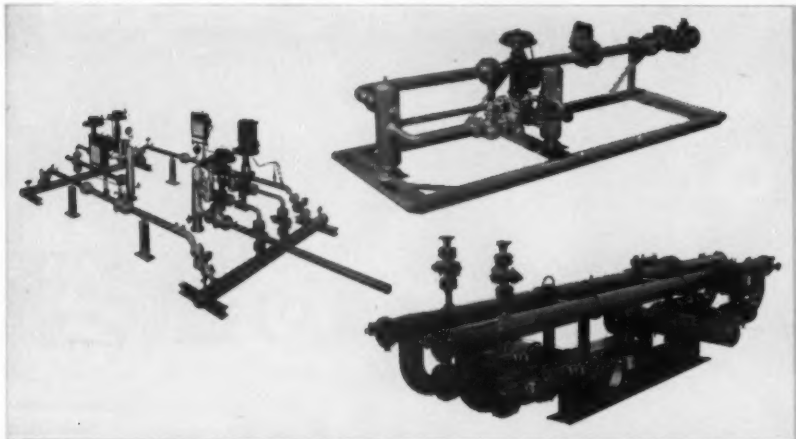
C-B Southern, a division of Cooper-Bessemer Corp., has transferred manufacturing operations of its short-stroke compressor line to Houston.

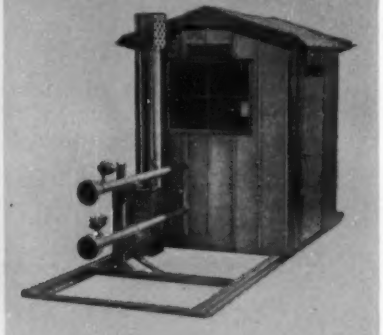
Corrosion • *Cont'd.*

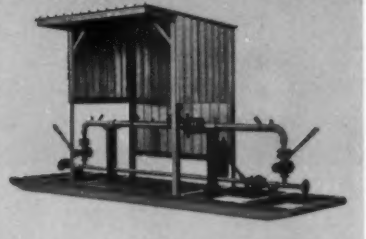
from page 21

years now, it having been impossible in this time to get a shutdown approved for this purpose. Since many miles of line are being deprived of cathodic protection, it may be possible to do this work when the line is shut down to repair the first leak.

Fences, ladders, mechanical supports and braces—the list of items which are not important to some, which may not be important enough to show on drawings, but which can do just as good a job of short-circuiting a joint as a bond, is all but endless. It has even been known to include a line, abandoned in place, removed from the company's books and from records, but tying together a protected line and an extensive bare system, not known or suspected to be closer together than a mile or two! ■







PACKAGED METER STATIONS

Start measuring gas immediately at the wellhead or at city gate sites with Daniel packaged, orifice meter stations. You save time in delivery, and save money in field labor costs with a complete Daniel package ready for tie-in to your line. Here are just a few examples of portable, skid-mounted units built by Daniel to customers' specifications. Each unit can be tested and X-rayed at the modern Daniel plant before shipping, and fitted with the meters of your choice. Want more facts? Write for Bulletin MS-1.

DANIEL ORIFICE FITTING COMPANY

9720 Katy Road
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•

3352 Union Pacific Avenue
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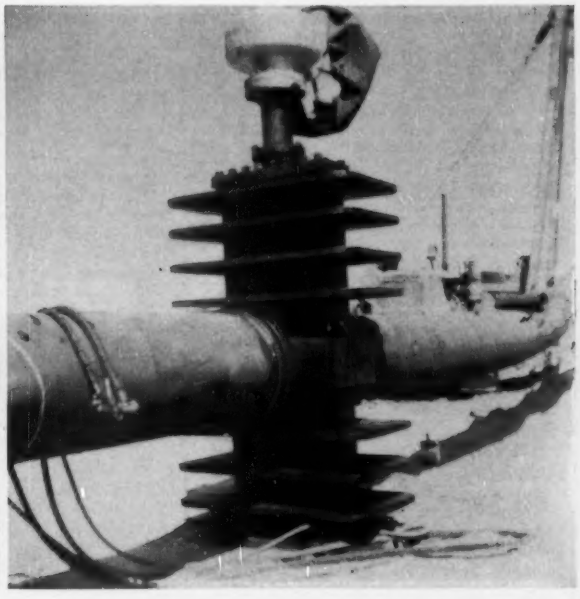
EL PASO NATURAL GAS COMPANY PROTECTS LINE VALVES WITH ROSKOTE COLD-APPLIED MASTIC

Roskote cold-applied mastic was spray-applied to 30" valves by El Paso Natural's personnel at Grants, New Mexico. Risers and support legs were coated with Roskote and wrapped with Royston Glas-Wrap for additional mechanical abrasion protection.



On the El Paso Natural Gas Company line being laid at Fort Stockton, Texas, by Western Pipeline Company, all 20" valves were spray-coated with Roskote cold-applied mastic.

You get superior protection against the most severe field corrosive agents with Roskote cold-applied mastic. Valves, risers, line pipe, tanks and other structures above or below ground are coated with Roskote by spray or brush without heat, flame or toxic and irritating effect on workers. The quick-drying feature of these mastics permits early backfilling. Roskote's time-saving, cost-saving application complements its low first cost to provide you with the most economical means of long-life metal protection.

Roskote is applied cold winter or summer. It retains its plasticity at 0°F, and will not run or sag at 250°F. Its high dielectric strength and resistivity, and its superior resistance to acids and alkalies provides ample protection even under the most rigorous underground or atmospheric corrosive conditions. Specific formulations are available for resistance to high crude oil concentrations and gasoline seepage in surrounding soil.

Royston engineers will give prompt attention to your inquiry.

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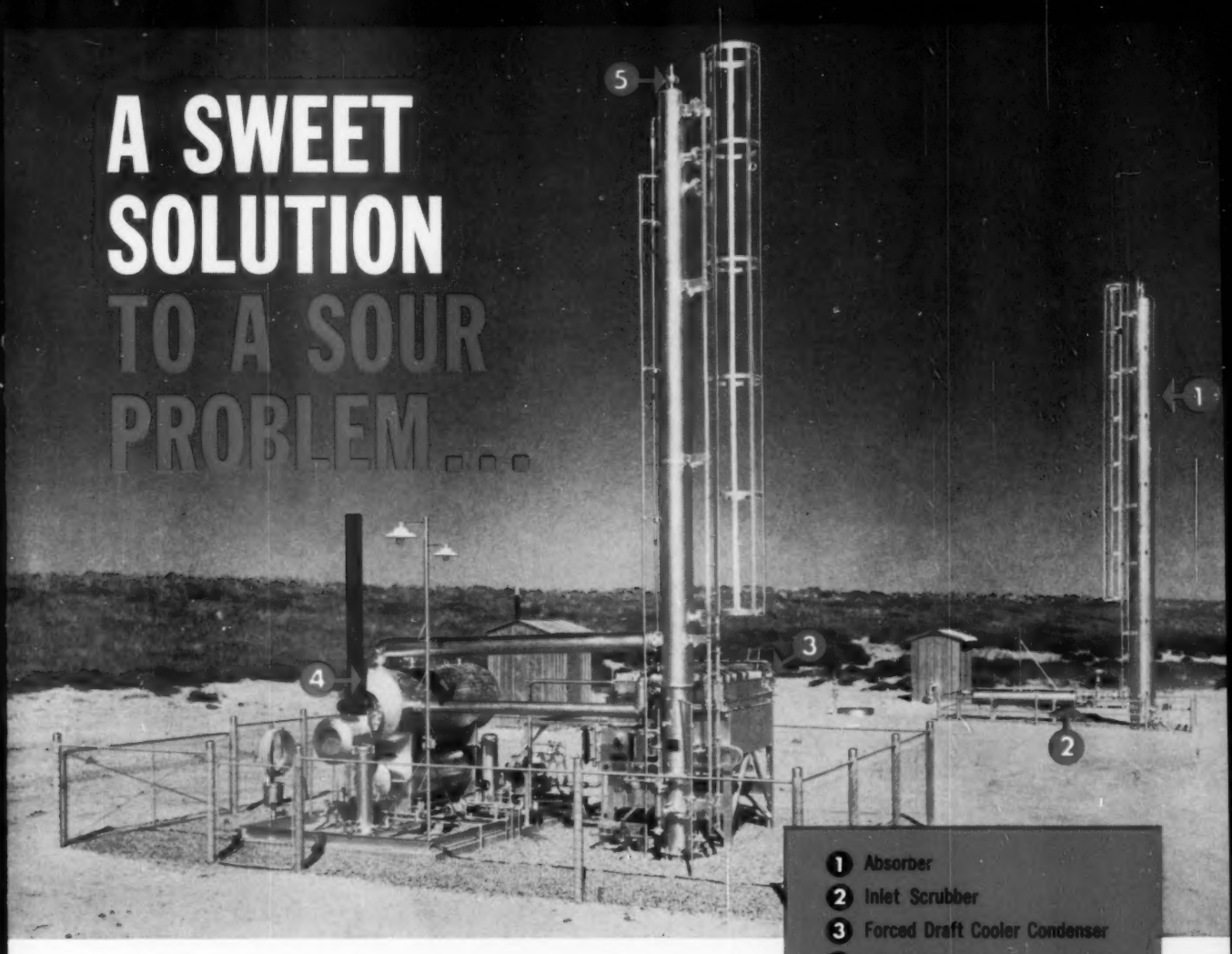

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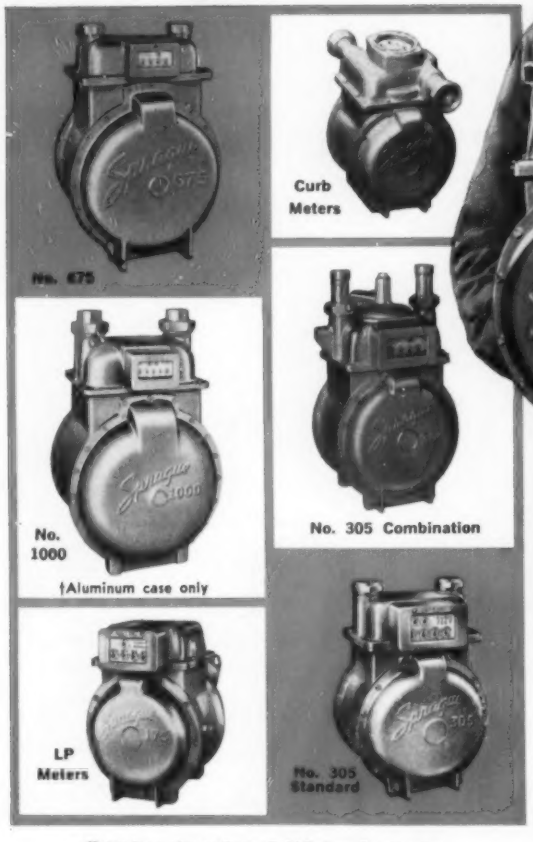

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